CLASS SIZE AT THE COLLEGE LEVEL

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FOREWORD

The experimental studies reported in this volume have been fostered by the University of Minnesota Committee on Educational Research. In the early days of this committee's existence the question of class size had become exceedingly perplexing. Increase in numbers of college students had irresistibly pushed up the size of classes until it was difficult to find rooms of sufficiently large size to house them. In addition to the administrative difficulties thus created there was widely prevalent the feeling that instruction in large classes was difficult, and that both students and faculty were being victimized by conditions which neither they nor the administration could control. The proposal to submit the matter to experimental investigation was received by the committee with some misgivings as to the possibility of a fruitful study, but the great importance of the issues involved was an obvious justification for an effort of even meager promise.

Accordingly, in April, 1924, a subcommittee was organized to outline a technique and to undertake as thoroughgoing an investigation of the matter as could be made. This subcommittee was composed of the following persons: Mr. W. S. Foster, Professor of Psychology; Mr. Everett Fraser, Dean of the Law School; Mr. Earl Hudelson, Professor of Education; Dr. R. E. Scammon, Professor of Anatomy; and Mr. F. von Borgersrode, Assistant Director of the Bureau of Educational Research. Professor Hudelson has acted as chairman of the subcommittee and director of the investigation. Throughout the period he has had cordial cooperation not merely from other members of the subcommittee, but from many instructors and administrative officers in the University. In a genuine sense the completed report is a cooperative affair. Great credit, however, is due to Professor Hudelson for his devoted and wise management of the investigation.

This report marks for the University of Minnesota a new approach to the study of its own problems, namely, that of experimental investigation. You have here not merely an examination of the university records, but the conscious attempt to set up experimental teaching situations, to control the contributing factors, and

to measure the influence of a single factor. As a method of studying college education this program can be made to bear large fruitage in the consideration of educational problems. If the investigation had done nothing more than to demonstrate the possibility of the experimental method as applied to the problems of college education, this study would have large significance. Such demonstration is probably more important in the long run than any specific finding concerning the effectiveness of instruction in classes of different sizes.

However, the results of the investigation as bearing upon the importance of class size in determining the achievement of college students can be regarded as little short of epoch making in their implications. A sufficient variety of subject matter and of teaching types was included in the investigatory program to suggest wider generalization than Mr. Hudelson and his co-workers have seen fit to make. However, within the scope of its investigation and confining its interpretation to demonstrated results, the committee concludes that class size is a minor factor in determining educational achievement. By all the usual measures for evaluating the results of instruction students achieve quite as much in large classes as they do in small, and there are some instructors at least who teach quite as effectively in large as in small classes. The significance of this finding lies in its meaning for the reorganization of college teaching. Small classes are expensive; large classes relatively cheap. If students in large classes achieve results equal to the achievements of those in small units, there can be no justification for the retention of the more expensive program.

Because of the obvious implication of these facts it is apparent that the results of this investigation will penetrate the organization and administration of our institutions of higher learning in a vital way and will effect important economies without loss of educational efficiency. Here are implications of the highest significance for the University's building program, for the organization of instruction, and for the character and qualifications of its teaching faculty.

M. E. Haggerty, *Chairman of the Committee on Educational Research*

ACKNOWLEDGMENTS

The Subcommittee on Class Size gladly embraces this opportunity to record its sincere appreciation of the interest and cooperation of the faculty of the University throughout the three-year investigation. Administrators have given of their time generously; officials have made necessary records available; instructors of all professional ranks have voluntarily undertaken controlled experiments; and the entire faculty has contributed many hours of thought and labor to the assembling of testimony. Such gratifying cooperation, unprompted by administrative influence, refutes, in the University of Minnesota at least, the tradition that instructors are oblivious to or indifferent toward their educational problems. The spirit in which the student body joined its faculty in attempting to solve this problem of mutual concern is also deeply appreciated. No less gratifying and essential has been the cooperation of the President and the University Committee on Educational Research, who recognized the problem, instigated the study, and encouraged, guided, and facilitated the work of the subcommittee by their wise counsel and generous support.

To Dr. Fred von Borgersrode, who was responsible for the statistical portion of the investigation, the other members of the subcommittee are deeply grateful for his technical advice and indefatigable labor.

EARL HUDELSON, *Chairman of the Subcommittee on Class Size*

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CHAPTER I

INTRODUCTION

Significance of the Problem

The question of class size is significant for several reasons. The most obvious is the cost of instruction, which is the greatest single determinant of educational expense, from the kindergarten through the university. The major factors involved in instructional costs are salary schedule and teaching load. Teaching load includes hours of teaching and number of students. As these factors are ordinarily administered today, class size is the greatest single variable determinant of educational cost. Increasing the size of classes, then, offers an obvious and tempting means to immediate educational economy.

But educational economy does not necessarily imply lower educational expense; it may mean a wiser allocation of funds. If larger classes prove feasible in all subjects and under all instructors, then, obviously, total costs should decrease; but larger classes in certain subjects may only release funds for departments in which large sections are impracticable, or the funds may be used to attract better instructors or for more adequate facilities. The promise of lower total expenditure is not necessarily implicit in any investigation of class size.

A less obvious but probably no less significant aspect of the problem is the relation of class size to educational opportunity. The school is indeed fortunate that can boast of more than a few great teachers. A very small proportion of the students, therefore, have an opportunity of coming under the influence of great leaders. This unintentional discrimination is hardly consistent with our ideal of equal opportunity; but it appears to be inevitable as long as small classes prevail. If it could be proved that all, or even some, of these master teachers can learn to handle large classes as effectively, or even nearly as effectively, as they handle small ones, a higher percentage of students could come into their rightful educational heritage. Even if only certain courses, or particular parts

of courses, were found to be adaptable to bigger classes, the effects of the enlarged influence of great teachers might be incalculable. Moreover, larger classes would effect economies that would enable institutions to hold their great teachers and attract others. Emerson visioned these possibilities when he said:

> My college should have Allston, Greenough, Bryant, Irving, Webster, Alcott, summoned for its domestic professors. And if I must send abroad (and, if we send for dancers and singers and actors, why not at the same prices for scholars?), Carlyle, Hallam, Campbell, should come and read lectures on History, Poetry, Letters. I would bid my men come for the love of God and man, promising them an open field and a boundless opportunity, and they should make their own terms. Then I would open my lecture-rooms to the wide nation; and they should pay, each man, a fee that should give my professor a remuneration fit and noble.[1] Then I should see the lecture-room, the college, filled with life and hope. Students would come from afar; for who would not ride a hundred miles to hear some of these men giving his selectest thoughts to those who received them with joy? I should see living learning; the Muse once more in the eye and cheek of the youth.

Closely related to this is the problem of instructional emphasis. At the University of Minnesota, for example, approximately 85 per cent of the teaching in the Arts College is being done in the junior-college courses. This means that less than one-fifth of the resources of this college are available for instruction at a truly university level. The facilities of the physical plant and the energies of the faculty are being usurped by students before they reach the senior college. As long as the unprecedented number of freshmen who surge over our university campuses each fall continues to be assigned to classes of thirty or less there seems to be no relief from this disturbing situation.

A fourth respect in which class size is of vital importance relates to the improvement of instruction. Probably the most significant trend in higher education today is its growing disposition to attack its own educational problems scientifically. Colleges and universities, following the lead of elementary and secondary schools, are becoming laboratories wherein attempts are being made to determine experimentally the best administrative and instructional techniques.

[1] A few years ago the faculty of a private college in America, seeing no other prospect of obtaining salaries sufficient to meet the increased cost of living, voluntarily inaugurated a policy of larger classes.

The University of Minnesota is playing a prominent part in this movement. Under the guidance of the Committee on Educational Research, many instructors are investigating their own classroom problems.

Now, this kind of teaching takes time. Just as the modern medical specialist devotes more time to research than to practice or consultation, so should the modern instructor have time to determine inductively his best ways of teaching. Many an instructor, burning with a vision of better service, is too busy to do more than behold the vision. Many who are cognizant of their opportunities for professional self-improvement are too heavily scheduled to seize the opportunities. Larger classes offer a possible means of relief. It may well be that the direst losses that could possibly accrue from larger classes would be more than compensated for by affording conscientious, competent, open-minded instructors a part of each day for introspection and modest research.

There is a growing sentiment that senior colleges and universities should put away childish things and begin to cultivate in their students initiative and a sense of responsibility. The spoon-fed diet is coming to be considered too soft for the proper conditioning of upper-classmen and graduate students. Compulsion is giving way to the practice of offering the student facilities and expert guidance and then insisting that he do a little thinking for himself. President Aydelotte of Swarthmore, a pioneer in this movement, sums it up by saying:

> I think the most important feature of the whole honors system, as it is being worked out in this country, is the fact that it puts more responsibility on the student. We think too much about effective methods of teaching and not enough about effective methods of learning. No matter how good our teaching may be, each student must take the responsibility for his own education, and the sooner he finds that out the better for him.[2]

Apropos of the rôle of the instructor, an article in the *Robbins College Bulletin* contends that "if the student has been faithful and has learned his lesson, then manifestly he has learned without the aid of the teacher. If he has been unfaithful and has not learned his lesson, then it is too late to learn in the recitation period. In either case the professor plays a minimum part in the student's

[2] Quoted in *What the Colleges Are Doing*, No. 25, May, 1927 (Boston: Ginn and Company).

mental progress."[3] A review of their publications reveals that over a hundred colleges and universities in the United States are committed to the principle of growing up and of demanding that their students grow up with them.

A prevalent reason for opposing large classes is that instructors cannot "get over" the class. Getting over usually means quizzing. Small classes, then, are better adapted to the paradoxical practice of having the teacher who, supposedly, knows, quiz the students who, theoretically, are there to learn from him! Yet the majority of these same instructors favor putting students more upon their own responsibilities. Many students, too, particularly those with initiative and independence, chafe under conformity, compulsion, and strict accounting. They claim that large classes afford them more of the freedom and individual responsibility which their instructors profess to believe in but fail to demand in small classes. This is the issue that prompted Professors Erikson and Buchta to inject into their series of class-size experiments in Physics[4] varying amounts of student initiative and teacher coercion. In the report of his initial experiment Professor Erikson said:

> The question of coercion, personal and otherwise, in educational matters is, of course, one of great importance. In the earlier school years there can be no question as to its necessity. When it comes to the college or university there can still be no question as to the necessity for the degree of coercion that is exerted through examinations. There is, however, a question in this case as to the advisability of daily personal coercion. May it not be that the community is better served by providing higher educational facilities only for those individuals to whom coercion is not necessary because of an inborn desire or hunger? Is it not quite likely that the slogan should be "Self-Education" and that the function of a university is to provide facilities which will be an incentive to self-education and which will, furthermore, make self-education more possible? Is it not probable that even now self-education is actually a more important factor than is commonly supposed; that the influence and aid of the instructor, though indispensable, are supplementary rather than predominating, and in many cases at least may be fully as effective *en masse?*

The issue of class size, then, is no mere local, ephemeral, superficial whim affecting only the externals of educational organization. Small classes, if they are to maintain, must justify them-

[3] Quoted in *What the Colleges Are Doing,* No. 25, May, 1927 (Boston: Ginn and Company).

[4] See Chapters VII and VIII.

selves in terms of the ultimate purposes of education. If they cannot do so they will have to yield to classes that can. Any changes that may come should be prepared for in advance, for the necessary adaptations can hardly be expected in a single generation of teachers. At any given time the optimum class size is that which produces maximum results with present facilities and under the best techniques of instruction and classroom management that teachers generally know how to use.

Class-Size Limitations, Real and Assumptive

It would be asinine to contend that there are no real limitations to class size. In situations, for instance, where lecturing is proved to be the best method, the hour is wasted for the student who cannot hear the lecture. If it is necessary to teach by means of visual aids, such devices must be within the range of vision of the class. To say that class size is limited to the number of students that the largest available meeting place will accommodate is simply platitudinous. An enforced policy of big classes might preclude that degree of specialization commonly considered the prerogative of upper-classmen and graduates in a modern university. The object of electives would be largely defeated in all but the most populous universities if such offerings were made contingent upon large class enrollments. These limitations are real, practical, serious, and inherent.

On the other hand, there is a much greater array of empirical objections to large classes. Some of the reasoning behind these antipathies is manifestly specious, while the soundness of other arguments depends upon conditions. One purpose of the present investigation is to try to determine which conclusions about class size are valid and when and why they are valid.

Prevailing Attitudes and Reasons Therefor

Large classes are generally unpopular among university instructors. Even the most charitable contend that while such classes may be educationally expedient they are probably never educationally advantageous. The aversions of a few instructors are so strong as to tax even their emotional equanimity. However unreasonable they may be, these instructors are sincere and their

attitude is accountable. They themselves were educated in small classes; they either inherited or early acquired the all-but-universal faith in small classes; in so far as they were trained at all they were trained to teach small classes; most of their teaching experience has been with small classes; and their students have fanned their fervor for small classes. Many instructors were trained and have taught in schools where small classes are a feature if not a fetish. If they have since made no effort to adapt their teaching procedures to large-class situations, these instructors may very well be having their best success with small classes. Moreover, in all too many cases large classes are instantly associated with increased teaching loads. To an instructor who, whether in imagination or in reality, is staggering under his present pupil load, the wishing upon him of more students is a weak incentive to experimentation. He is tempted to remind his administrative superiors that one should never stop a man to preach heaven to him when he is running to catch a train, lest he miss both. It is not surprising, therefore, that university instructors, with their training and experience, find it easy to rationalize; nor is it strange that practically no sustained attention has been paid to class size at the university level.

But the question is too momentous to be left to personal predilection, and cannot truly be called settled until every reasonable effort has been made to adapt teaching procedures to large-class situations. Moreover, educational efficiency is a relative, not an absolute, matter. The faculty of the University of Minnesota, recognizing its simultaneous obligations to the student and to the state, has submerged its preferences and devoted itself for three years to an attempt to solve the complex problem of class size.

History of the Investigation

Several years ago President Coffman appointed a University Committee on Educational Research, consisting of administrative officers and other faculty members specifically interested in the study of university education, to investigate whatever it might conceive to be outstanding educational problems in the University of Minnesota. At least three members of the faculty had already carried on independently in their courses modest experiments on

class size and had found some rather disconcerting indications. These isolated studies and Edmonson's report of his experiment at the University of Michigan[5] had come to the attention and aroused the concern of the Committee on Educational Research. Deciding to encourage further investigations along this line, it appointed, in 1924, a subcommittee on class size.

The subcommittee's conception of its functions is indicated in its first report of progress, submitted in December, 1924.

> The subcommittee on class size believes that its proper duties are to make available a review of the reports of previous investigations; to draw up suggestive experimental techniques for attacking the problems of class size; to make these techniques available to all instructors who may be interested; and to stand ready to advise and assist in the technical aspects of any experiment that may be undertaken. It is felt particularly that the subcommittee may be of service where intelligence tests need to be selected and administered; in pairing students for controlled experiments; where instructors desire to supplement their regular examinations with objective tests; and in the statistical analysis and interpretation of experimental results.

The subcommittee did not then contemplate nor has it at any time attempted either coercion or suasion. Every experimental contribution to the investigation has been volunteered. The faculty of one department, for instance, having been granted an appropriation for a new building and wishing to know the most efficient size or sizes of classrooms to provide, requested the subcommittee to devise an experimental technique for determining the optimum class size or sizes in that department. The specter of rapidly mounting enrollments has inspired many of the experiments. Suffice to say, the motives have been practical throughout.

The Problem Analyzed

Upon careful analysis the problem of class size resolved itself into these major considerations:

1. What is the optimum class size (or sizes) under present methods of instruction and classroom management?
2. If small classes are better, are they enough better to justify the inevitable increase in costs?[6]

[5] Reviewed in Chapter II.

[6] Stevenson found, for example, that it cost Chicago $15.00 per pupil to teach high school English in large classes to the point represented by a term mark of

3. If small classes show little or no advantage over large classes under present methods of instruction and management, can techniques be so refined or otherwise modified as to produce results favorable to larger classes?
4. If students achieve as well, or even nearly as well, in large classes as in small ones, can the continued maintenance of small groups be justified? May there be other important outcomes which can accrue only from small classes? If so, can these be isolated, controlled, and measured?
5. If somewhat larger classes prove to be practicable, how much larger can they be made without loss of efficiency?
6. Do students under present prevailing standards of class size really receive more individualized instruction than can be devised for larger classes?[7]
7. May it be that there are two supplementary but distinct problems—mass instruction on the one hand, on the other, individual or case treatment for students who deviate significantly from the mass in their characteristics and needs?
8. Under present standards and policies of financial support, how can universities most nearly realize their aims and perform their functions—by reducing the size of classes or by evolving means of handling larger classes as effectively as possible?
9. Will relative results in large and small classes be the same for all students in all subjects under all teachers and with all methods of instruction? If not, what are the critical factors in class size?
10. If certain instructors are found to be capable of handling large classes effectively, what is there about them or their teaching that enables them to do it?
11. If certain teaching procedures are found to be peculiarly adapted to large classes, can a sufficient number of instructors be trained to use those procedures?
12. Do the practices necessary to the success of large classes impose unreasonable demands upon teachers or students, or can administrative cooperation obviate or compensate for all unreasonable conditions?
13. However successful large classes may prove to be in experimental situations, are they generally feasible with present facilities and under other existing conditions?

77 per cent, whereas it cost $28.00 per pupil to break classes into small enough groups to raise the average term mark to 78 per cent. See also the cost studies by Erikson and Buchta in Chapter X.

[7] Cornman (see Chapter II) suspected that real individualized instruction is possible only in classes so small as to be prohibitively expensive.

The Program of Investigation

To answer as many as possible of the above questions the subcommittee projected the following program of investigation:

1. To ascertain, by means of a questionnaire, the attitudes of the members of the faculty toward class size and their reasons therefor; the teaching methods which they have found to be most successful with large classes; and classroom procedures which, in their opinion, are least suited to large classes.
2. To secure from a representative sampling of students their attitudes toward class size and their reasons therefor; the personal characteristics of instructors who, in the students' opinion, are peculiarly successful large-class teachers; and descriptions of successful small-class and large-class teaching techniques.
3. To visit the classes and analyze the procedures of reputedly successful large-class instructors.
4. To study trends in class size throughout the University over a period of years.
5. To study the effects of class size upon student achievement as expressed in student marks.
6. To analyze the results of large and small classes conducted under uncontrolled or semicontrolled conditions.
7. To encourage and assist in the prosecution and to analyze the results of as many controlled class-size experiments in as many colleges or departments and under as many instructors and methods of teaching as possible.
8. To assemble all available evidence on the relation of class size to educational costs.

While limitations of time and facilities necessitated the curtailment of certain of the original plans, none were entirely abandoned. Each plan is treated in more or less detail in subsequent chapters. Each, it is believed, contributes its part to the solution of the general problem of evaluating the effect of variation in class size upon the direct, measurable outcomes to the student, together with the concomitant implications as to costs, desirable qualities in instructors, and suitable techniques of instruction.

Sources of Data

The chief source of data has been actual experimentation carried on in 104 classes in the University of Minnesota through the

courtesy and with the cooperation of twenty-one instructors in eleven departments in four colleges. The experiments involved 6,059 students—4,205 in large classes and 1,854 in small. Comparative results are based upon 1,288 carefully matched pairs of students. The bulk of the supporting data on student scholarship has been drawn from class reports and student records on file in the registrar's office. Instructors' classbooks have also supplied much information. Intelligence records were obtained largely through the courtesy of Professors D. G. Paterson and W. S. Miller. Wherever necessary the records have been supplemented by personal interviews. Testimonial data were derived from replies to questionnaires, copies of which are exhibited in the Appendixes.

Methods of Investigation

The methods primarily employed in making the investigation were experimental, statistical, and the use of the questionnaire. Special stress was laid on experimental classroom projects because it was believed that evidence gained from them would have most vital import. Treatment of the evidence was limited to the simpler statistical processes. Instead of subjecting limited data to extremely refined statistical techniques, it was considered of more defensible value to secure the same end by increasing the number of corroborating units of evidence. A determined effort was made to increase the number of separate experiments to the point where a range of significant factors might be uncovered which mere statistical manipulation would be powerless to disclose.

CHAPTER II

REVIEW OF INVESTIGATIONS ON CLASS SIZE

A number of studies of more or less significance on one or another phase of the problem of class size have been made during the last thirty years. Though some of them now appear crude and their results inconsequential, most of these studies employed the best investigative techniques available at the time. They range all the way from the mere comparison of teachers' subjective estimates through improvised local tests up to standardized objective outcome tests administered to carefully paired pupils in small and large classes under controlled conditions. They also range from a few pupils up to Stevenson's elaborate experiments in some of the largest school systems in the country. Rarely have the large-class teachers seriously attempted to adapt their procedures to their large classes. All that can fairly be claimed for the results of most of the investigations is that conventional small-class techniques were or were not effective with large classes.

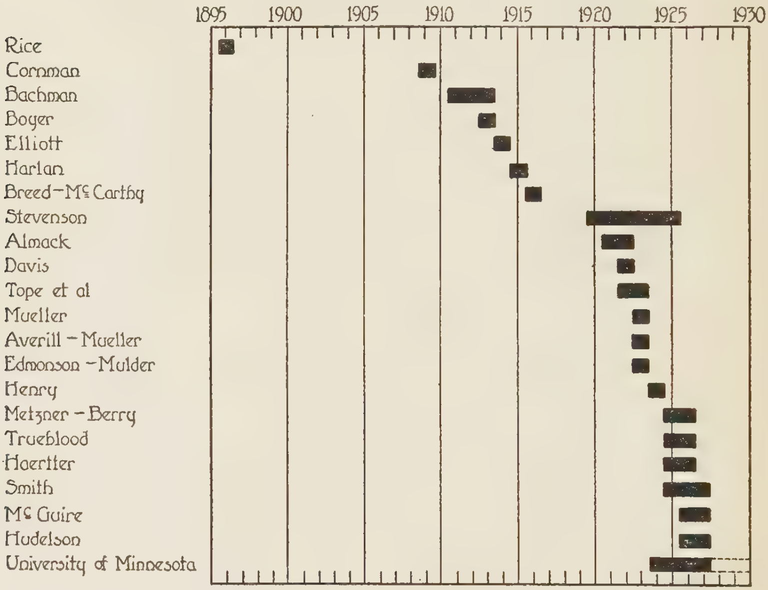
The problem of class size has been attacked from various angles. Instructional efficiency, for example, has been measured in terms of relative costs, scores on standardized or non-standardized achievement tests, rate of promotion, per cent of failures, per cent of withdrawals, pupil improvement, pupil participation, distribution of school marks, economy of time, pupil attention in class, time spent in routine classroom activities, pupil conduct, and opinions of pupils, teachers, and administrators. Roughly speaking, however, the investigations have been concerned either with administrative efficiency or pupil accomplishment. The first involves wealth per pupil, cost per pupil, cost per class, and pupils per class. Comparisons are based upon the median tax rate and the median class cost for the country as a whole. Since class size reacts upon school costs, which in turn make demands upon taxable resources, it is possible to compute the effects of class size upon school costs and taxable wealth. Using the median tax rate and median class costs as standards, the present and the theoretical efficiency of schools or school systems can be calculated. That is, one may place a city, for example, on a scale with respect to all

other cities (or, better, with respect to all other cities of its size and social composition) and compare what it is doing with what it may reasonably be expected to do. The basis of comparison is, of course, that point where results equal costs. In other words, the ideal ratio is 1. Almack (41)[1] actually computed a size-of-class efficiency index for elementary schools in the 196 cities of the country having [at that time] a population exceeding 30,000. He determined that for these cities, costs most nearly equal results in classes enrolling 38 pupils. He also concluded that none of these cities with its [then] present wealth could maintain elementary school classes of fewer than 25 pupils without exceeding the median tax rate.

The other approach to the problem has been through comparative studies of educational results from classes of various sizes. Before reviewing these it should perhaps be noted that the two

FIGURE 1

Chronological Chart of Investigations on Class Size



[1] The number in parentheses immediately following an investigator's name refers to the entry so numbered in the appended Bibliography.

angles of approach, though different in emphasis, are not mutually exclusive. In the study already referred to, Almack established a rather arbitrary criterion of instructional efficiency as his basis of comparison. Moreover, he assumed that, within limits at least, reducing class size will increase educational efficiency. This is the very question that the second type of investigation seeks to answer. In neither type, however, can school costs be wholly ignored. Obviously, if it were postulated that results are indirectly proportional to class size, schoolroom application could easily reach the point of *reductio ad absurdum.* The major factor in either type of investigation is, therefore, inevitably a minor factor in the other.

Any exhaustive study of the relation of class size to educational efficiency must involve, in addition to class size proper, a consideration of such factors as the aims of education, the intelligence of the students, the ability of the teacher, the physical facilities of the classroom, the nature of the subject matter, the size of the classes to which the pupils have been accustomed, the efforts made by the teachers to adapt instruction to the size of the class, and the reliability of the means employed for measuring teaching ability and student accomplishment. No such exhaustive study of class size has yet been made. None could have been made prior to about 1915, for until that time no reliable means were available for determining the intelligence and achievement of pupils. But even since 1915 investigators have not always utilized reliable measures of these factors, and means of judging teaching efficiency are still very imperfect.

Most of the investigations on class size have been confined to the elementary school. Only within the last few years have high schools approached the problem scientifically. There has been one investigation in a normal school. Michigan and Minnesota seem thus far to be the only universities audacious enough to raise the question of class size, and at Michigan the investigation appears to have spent its force on a single experiment in a single course. Though it did not utilize every feasible means of comparison, the Michigan study consisted of an otherwise carefully controlled experiment and observed typical university classroom conditions and procedures. It will be summarized in its proper chronological

place in the following review of all the significant investigations that have been found concerning the relation of class size to educational efficiency.

By means of the best tests then available, Dr. J. M. Rice (56 and 57) in 1896 measured the arithmetic ability of six thousand children in grades IV to VIII, selected from eighteen schools in seven cities. Though he found that the number of pupils per class was larger in the six schools having the highest scores on his tests than in the schools having the lowest scores, the results, in his judgment, warranted the conclusion that there was no significant relationship between class size and achievement in arithmetic as measured by his tests. He came to the same conclusion as a result of his tests of language achievement, which he administered to 8,300 children in grades IV to VIII in nine cities. These studies, like all of the investigations made by this pioneer, were carefully conducted with the best technique then available. Nothing was reliably known about the pupils' intelligence, the ability of the teachers, or the size of class to which the pupils were accustomed.

In 1909 Cornman (45) studied the progress of 320 primary and grammar grade classes in Philadelphia from three angles—promotion per cents, monthly reports, and pupil conduct. The classes were arranged in three groups according to size, as follows: under 40, 40 to 49, and 50 and over. The highest promotion record was made by the middle-sized group. The record of the 50-and-over group was 2.9 per cent below that of the under-40 group. Cornman concluded that the results of his promotion-rate study failed to reveal any significant advantage either way; that, by and large, classes of medium size make the best showing; that, on the whole, large classes do not fall much below the other groups; that in the grammar grades, the larger the class the better its promotion record; and that classes containing 50 or more pupils make a poorer showing in the primary than in the grammar grades.

Cornman's analysis of report-card data led him to conclude that in the grammar grades the largest classes received the greatest per cent of high marks; that in the total for all grades the medium-sized classes (40 to 49) made the best record; and that

in the primary grades the smallest classes rated highest. The records of pupil conduct revealed that the largest classes showed up best and the medium-sized classes worst. Cornman contended that there is a problem of mass education and that there is an entirely different problem of individual development. The latter, he claimed, should supplement the former when special conditions need to be met. He therefore recommended regular elementary school classes of 40 to 50, with classes of 15 to 25 for pupils who offer special problems.

In 1913 Boyer (43) made a similar study of promotion rates in ten districts of Philadelphia. He found that in the primary grades the advantage lay with the medium-sized classes but that in the grammar grades promotion rates decreased as the size of the class increased. Boyer was not satisfied with promotion rate as a basis of judging teaching efficiency and urged the need of reliable tests for this purpose.

Bachman (9) during the years 1911-13 made a study in New York similar to those of Cornman and Boyer in Philadelphia. Bachman found only one more promotion per each ninety-four pupils in classes of fifty-and-under than in classes of over fifty.

Elliott (17) in 1914 studied the promotion rates of several cities for elementary school classes of sizes ranging by fives from twenty or less to over fifty, and found no relationship between class size and promotion. He also tested fifth- and seventh-grade pupils in composition, spelling, handwriting, arithmetic, and range of vocabulary and found that in the fifth grade the larger classes were superior in writing, arithmetic, and composition, but inferior in spelling and range of vocabulary. In the seventh grade the larger classes were superior in composition but inferior in arithmetic, spelling, and range of vocabulary.

Pupils who had been taught in large classes for at least four years were compared with pupils who had been taught in small classes for four or more years. The fifth-grade pupils with large-class experience were found to be superior in composition and arithmetic but inferior in vocabulary, penmanship, and spelling. In the seventh grade the large-class pupils excelled in writing but were inferior in the other subjects.

Finally, Elliott measured the improvement of pupils in pen-

manship and language over a period of seventeen weeks. In one city the 83 classes that were measured in handwriting showed that (1) among classes which revealed no growth the small classes outnumbered the large three to one; (2) the lowest per cents of improvement were made in the small classes; and (3) the number of classes making a gain of 15 per cent or more beyond their initial records was greater among the large classes. In 42 classes measured in language the biggest gains in points were made by the large classes. Elliott's conclusion was that "results taken for the sole purpose of studying the improvement made by children show no correlation between class size and attainment."

Harlan (49) in 1915 investigated promotion rates in 1,346 classes in thirty-two cities. He found promotion rates in all elementary grades to be rather uniformly low for classes of 56 or more pupils and that, except for grades II and VII, the maximum rate of promotion was in the smallest classes and the minimum rate in the largest. Harlan also studied the records of withdrawals and concluded that the larger the classes the higher the percentage of permanent withdrawals, and that large classes, if not the cause, were at least accompanied by a high proportion of voluntary elimination. Other factors investigated by Harlan elicited from him the following conclusions: (1) Class size is not an important factor in determining the number [percentage?] of pupils giving attention to the recitation. (2) There is no regular increase in the percentage of pupils not taking active part in the recitation corresponding to the increase in the size of class. (3) There is no regular increase in the amount of time consumed in performing routine classroom activities as the size of the class increases; class size is not an important factor in efficient classroom management. (4) Small classes seem to waste more time (absolutely as well as proportionately) than large classes do.[2]

Harlan also studied the arithmetic attainment of 675 classes in all elementary grades widely scattered throughout the country. He found that "without exception medium-sized classes are supe-

[2] E. R. Smith and Stevenson both contend that these matters are relatively insignificant in that they depend far more upon the teacher than upon class size. Stevenson also deprecates evidence gathered from promotion rates because of the tendency of schools to set arbitrarily their independent policies of promotion. Certainly customary methods of assigning school marks are open to the same criticism.

rior to large and small classes in achievement in arithmetic as measured by the Courtis Tests.[3]

In none of the foregoing studies was account taken of such factors as teaching ability, pupil intelligence, and environmental influence. Moreover, except in Elliott's investigation, no data were obtained as to the size of classes to which the pupils were accustomed.

In 1916 Breed and McCarthy (44) reported a more carefully controlled experiment with 58 classes on the relationship of class size to efficiency in spelling. Each large class was paired with a small class in the same town or in a town of about the same size. A preliminary test of eighty words was given to both classes. After twenty days of study the same words were given again as a final test. The amount of time devoted to study and recitation, the number of words assigned each day, the method of teaching, the personnel of the testing staff, and, in so far as possible, the ability of the teachers, were all kept constant in this experiment.

All large classes showed a greater per cent of improvement except those in grades III and VII. A further comparison was made of classes of different sizes having the same initial spelling ability, with substantially the same results. Fifty-nine per cent of the large classes exceeded in improvement the small classes with which they were paired. There was a regular increase in the amount of improvement from an enrollment of twenty to an enrollment of forty-five; beyond forty-five, a decrease. The authors recommended that classes in the elementary school of less than forty, especially below the seventh grade, be increased to forty or forty-five.

The results of investigations conducted before 1917 indicate that, in general, unless elementary school classes exceed 45 or 50 there is no clear evidence of diminished efficiency. Thus far, however, there had not been taken into consideration a number of factors which may reasonably be expected to affect the results of teaching. No devices were then available for measuring some of these factors. Progress had gone about as far as it had the means of going; consequently after 1915-16 there was a lull of

[3] This is the earliest recorded use of standardized tests for the purpose of determining the relative efficiency of classes of various sizes.

four or five years while educational scientists were deriving, refining, and standardizing intelligence and achievement test materials. When experimentation was resumed about 1920, these powerful instruments were at hand to aid investigators in measuring factors that theretofore they had not been able to control.

These refinements in experimental technique were soon applied to the problem of class size. In 1920 Stevenson (32) began a protracted investigation which continued till his untimely death in 1926. The first unit of the elementary school part of his study consisted of a controlled experiment with fifty classes in grades II, V, and VII in five elementary schools of Chicago. The fifty classes were taught by twenty-five teachers. Each teacher, in other words, taught a pair of classes—a smaller and a larger. Half of the larger classes were taught during the first semester and half during the second; likewise the smaller classes. In every case the paired classes were taught by the same teacher. They consisted of identical pupils except as children were added to or subtracted from the first-semester group to vary the size of the class. Stevenson's data, however, are confined to those pupils who were taught by the same teacher in both classes.

The intelligence of each pupil was tested, and paired classes were so manipulated that they were equal in both median intelligence and in variability. Attainment tests were given at the beginning of the first semester, at the end of the first semester, and at the close of the second semester. The final test of the first semester constituted the initial test of the second semester. Comparable forms of the same tests were used. Each semester covered fourteen weeks. Grade II was tested on spelling, word recognition, arithmetic, and understanding of sentences. Grades V and VII were measured in arithmetic, silent reading, and language. The aim of the investigation was to determine the extent to which the gains in small classes exceeded those in large classes, or vice versa, when the gains were made by the same pupils and the paired classes taught by the same teachers.

For the 305 second-grade pupils, the average gain per pupil was in favor of the larger classes in all tested subjects except word recognition. The difference in all subjects in favor of the large classes was 19 per cent. The differences in arithmetic

(51%) and sentence understanding (30%) were large; those in spelling (6.5%) and word recognition (9%) were small. For the 430 fifth-grade pupils, the average gain per pupil in all subjects combined was 24 per cent in favor of the smaller classes. The advantage was with the large classes in arithmetic (16%), but with the small classes in reading comprehension (77%), reading rate (43%), and language (21%). For the 141 seventh-grade pupils, the average gain per pupil in all subjects combined was 53 per cent in favor of the small classes. Only in rate of reading was the advantage with the large classes. When all three grades are combined in all subjects that were pursued in common, the results show a gross superiority of about 8 per cent in favor of the small classes, or an average superiority per pupil of six-tenths of a T-score unit.[4]

Stevenson's conclusions were:

> Children in higher grades profit rather more by small classes than do children in the lower grades. If further investigation confirms this, the practice of teaching children in larger groups in the lowest grades would seem to be justified. We are, however, by no means prepared to take this position, since in this matter, as in so many others in connection with our investigation, the outstanding condition is not one of difference but rather of indifference. The small and conflicting superiorities one way or the other by small and large classes indicate that both good and poor teaching may be done in both large and small classes. So far, the size of classes, even when important influences affecting teaching are made constant, seems to determine the result only to a very small degree.

Stevenson also studied the relation of class size to improvement of bright, average, and dull pupils in grades II, V, and VII. All pupils whose intelligence scores were less than the median score of the class immediately below were considered dull; all who were higher than the median of the class immediately above were counted bright; while all who fell between these two points were called pupils of average intelligence. Stevenson's study involved 211 bright pupils, 360 children of mediocre capacity, and 312 dull pupils. The gains made by each of these three groups in large and small classes were computed. The results led Stevenson to the conclusion that "small classes were, in general, of greatest advantage to the dull pupils." The bright and average

[4] A T-score unit is one-tenth of a standard deviation.

children made greater gains in the large classes than in the small classes in all subjects except language. The dull pupils made greater gains in the small classes than in the large classes in all subjects except spelling (which figured only in the second grade). Stevenson contended that "all the advantage of the small class is brought about by the presence of the dull pupils." Average pupils profited about the same, whether they were in large or small classes. The difference in gains for all pupils was in favor of small classes by one point (7.9 as against 6.9). Dull second-grade pupils did not benefit by small classes, but among dull pupils in grades II, V, and VII combined, 56 of each 100 did better in the small classes.

An analysis of reading revealed that, in Stevenson's words, "if there is any definite conclusion with regard to reading, it is that rate increases in the large classes, while comprehension is unaffected."

In the first recorded high school investigation Stevenson (32) paired 134 Chicago high school classes (2,821 pupils) on the basis of intelligence medians and variability and studied their records in class work and on final examinations. He concluded from the results that "on the whole small classes did slightly—very slightly—better on term work and examinations than did the large classes with which they were paired. . . . The sixteen teachers seem to be able, according to their own ratings, to teach 600 high school pupils about as efficiently as they do one-half that number." [5]

When Stevenson compared the bright, average, and dull high school pupils in large and small classes he found that "all pupils combined derived a little more benefit from the small than from the large classes, and the average pupils obtained the greatest benefit." Small classes were found to be most favorable to the average pupils, next most favorable to the dull pupils, and least advantageous to the bright pupils.

Stevenson recommended: (1) that for future investigations the IQ rather than the intelligence score be used as a basis for classification; (2) that the special abilities of pupils in a given subject

[5] This forces the issue: How much superiority should a small class show over a large one before the small class is justified?

be used as a partial criterion in classifying pupils into equal-ability groups; and (3) that a preliminary study be made to provide a large number of teachers of known ability to perform the experiment. It would then be possible, Stevenson felt, on the basis of gains made between initial and final tests, to correlate class size with educational results. We might then be in a position, he further believed, to determine the optimum size of classes in general, for teachers of different abilities, and for various school subjects.

The chief limitation to the elementary school part of Stevenson's study was the small difference in size between his "large" and "small" sections. This was due to his inability to secure markedly small groups in actual school practice. Though Stevenson did not state how small the differences were, it appears from his Tables XIV, XV, and XVI that in the second grade the average size of large classes was 49.7 and that for the small classes 32.7; in the fifth grade, 47.2 and 37.6; and in the seventh grade, 46.75 and 38.5. In the high school part of his Chicago study the differences in size were significant.

Though there is no published experimental evidence on them, an urgent need for research on these two highly important questions was revealed in the course of Stevenson's study:

1. Would classification on the basis of intelligence make any difference in the relative improvement made in large and small classes?
2. Can large classes of homogeneous intelligence do better work than can be done by small classes composed of very bright or very dull pupils?

Stevenson did find (see Table II) in a comparison of intelligence scores, examination scores, and term ratings of bright and dull pupils in large and small high school English classes (1) that in the large classes the bright pupils made 117 per cent larger intelligence scores while their term and examination marks were only thirteen or fourteen per cent higher; (2) that in the small classes the bright pupils made 61 per cent better scores on the intelligence test but did no better work than the duller pupils as measured by their term and examination ratings; and (3) that there is apparently a decided waste of ability among those of high intelligence in both large and small high school English classes.

By way of checking his Chicago high school results, Stevenson (34) also compared the examination scores and term averages of

large and small classes in Lynn, Massachusetts, Covington, Kentucky, and Grand Rapids, Michigan. The experimental technique was similar to that, and the results supplementary to and confirmatory of, those of Stevenson's Chicago high school investigation. It is apparent from Table III that in Lynn, Covington, and Grand

TABLE II

COMPARISON OF ACCOMPLISHMENT BY BRIGHT AND DULL PUPILS IN LARGE AND SMALL CLASSES IN HIGH SCHOOL ENGLISH
(After Stevenson.)

	Large Class			Small Class		
	Intelligence Score	Term Rating	Examination Score	Intelligence Score	Term Rating	Examination Score
The seven pupils having the highest intelligence rating	141	85	82	111	80	79
The seven pupils having the lowest intelligence rating	65	75	72	69	80	81
Difference between average ratings of bright and dull pupils	76	10	10	42	0	— 2
Per cent of difference between average ratings of bright and dull pupils	117	13	14	61	0	—.03

TABLE III

COMPARATIVE ABILITIES AND MARKS IN LARGE AND SMALL HIGH SCHOOL CLASSES IN LYNN, MASSACHUSETTS, COVINGTON, KENTUCKY, AND GRAND RAPIDS, MICHIGAN
(After Stevenson.)

Subjects	Size		Intelligence		Examination		Term Average	
	L	S	L	S	L	S	L	S
Algebra	37	15	107.7	109.9	73.1	76.3	83.8	82.1
Latin	38	20	109.4	113.2	72.1	77.8	83.7	85.8
Ancient history	37	17	109.9	112.6	75.5	73.0	76.9	78.5
U. S. history	38	19	96.4	97.2	63.0	69.8	63.0	68.6
English II	36	18	102.3	103.4	65.3	60.3	71.4	66.7
Total	186	89	525.7	536.3	349.0	357.2	378.8	381.7
Average	37.2	18.6	105.1	107.2	69.8	71.4	75.8	76.3

Rapids the smaller classes had an advantage of 1.6 points on average examination marks and of half of one point on term averages. The slight superiority of the small classes in intelligence may have accounted for these differences in achievement. Stevenson concluded:

> We do not know the amount of superiority which a small class ought to show over a large one before the former justifies itself. We certainly hesitate to say that one or two points on the percentage scale are sufficient to justify small classes of approximately one-half the size of large ones. Since the amount of money spent for teaching in a modern high school approximates two-thirds to three-fourths of the total cost, the question of the size of classes is a highly important consideration in the total amount of money spent for schools.

Stevenson's (35) culminating study consisted of controlled experiments with large and small heterogeneous classes in the second, fifth, and seventh grades in Akron, Cincinnati, Cleveland, and Toledo. This investigation, designed to correct the shortcoming of his Chicago elementary school experiments, involved significant differences in class size. The data are based upon the achievement records of 1,129 pupils. There were twenty-six pairs of classes in the second grade, twenty pairs in the fifth grade, and sixteen pairs in the seventh grade. Each cooperating teacher taught a large class and its paired small class, one of which was taught during the first semester and the other during the second. The results are based upon only those classes which, being large the first semester, had a corresponding small class the same semester.[6] All factors which were believed to influence the efficiency of instruction were kept as constant as possible except that of class size. Efficiency was measured in terms of the improvement made during the first and second semesters as indicated by scores on standardized tests. Measurements were taken at the beginning of the year, after fourteen weeks, and after twenty-eight weeks. In order to render the measurements in the various school branches comparable, all interpretations of improvement were expressed in terms of T-scores. Test papers were marked by the teachers and the scores checked. The results are shown in Table IV. While the direction of the advantage varied as between classes and sub-

[6] This policy was determined upon because efficiency was to be measured in terms of pupil progress, and improvement was consistently greater during one semester than the other.

jects, the general results were practically balanced in the second and seventh grades but decidedly in favor of large sections in the fifth grade. Small classes seem to have been particularly advantageous in spelling and large ones in reading.

TABLE IV

DIFFERENCES IN IMPROVEMENT BETWEEN LARGE AND SMALL CLASSES IN AKRON, CINCINNATI, CLEVELAND, AND TOLEDO, OHIO

(After Stevenson.)

Abilities	Grade II		Grade V		Grade VII	
	L	S	L	S	L	S
	Av. 42	25	Av. 44	26	Av. 41	25
	R. 32-50	19-32	R. 34-54	18-32	R. 32-48	16-30
	Per cent of advantage	In favor of	Per cent of advantage	In favor of	Per cent of advantage	In favor of
Arithmetic	8.69	Small				
Problem solving			1.24	Large	13.92	Small
Problem analysis			3.24	Small	19.68	Large
Language	19.96	Large	10.97	Large	24.92	Large
Grammar					18.15	Small
Rate of reading	19.06	Large	249.78	Large	48.28	Large
Reading comprehension			118.26	Large	6.23	Large
Spelling	1.80	Small	25.22	Small	20.51	Small
Combined abilities	2.53	Large	22.29	Large	2.89	Large

Stevenson also found that in grade II the greatest progress was made by the largest classes, while the least advancement was made by classes between 30 and 40 in size. In grades V and VII the pupils consistently improved as the size of the class increased. All subjects considered, small classes were most advantageous to dull second-grade pupils and least advantageous to bright ones. Honors were even for second-grade pupils of mediocre ability. The bright fifth-graders were at a distinct advantage in large classes except in spelling. Little advantage is apparent either way for the mediocre and dull fifth-grade pupils. In the seventh grade the bright pupils were at an advantage in small classes, the dull pupils in large classes. In the three grades combined, honors were about evenly divided.

Stevenson also manipulated his data to ascertain the class size

at which diminishing returns set in. He found that in grade II the advantage shifted from the large to the small classes when the size was increased from 43 to 45. In grade V diminishing returns were not apparent in classes up to 48 in size. In grade VII the advantage in favor of large classes maintained for groups as large as 45.

During 1921-22 Almack (41) carried on an experiment in the Training School of Teachers College, San José, California. The attainment of pupils while in a small classs was compared with their attainment while in a large class, the mental ages of the two groups being equal both in range and central tendency, and an effort being made to reduce the variables to one, namely, size of class. Subject matter, however, was different in the two classes, and teaching ability probably varied. Almack's findings led him to the conclusion that "results are independent of the size of the class."

Almack also secured the judgments of 1,088 experienced elementary teachers and school superintendents on the optimum size of class in relation to instruction, discipline, and demand upon the energy of the teacher. In their opinion average results may be expected from classes of thirty-six.[7]

During the months of May to December, 1922, Davis (46) conducted a twofold investigation to determine the relative results of class sizes in the high schools accredited by the North Central Association. One of these studies consisted of an analysis of the term marks recorded in the principals' offices during the first and second semesters of the school year 1921-22, and the determination of the percentages of pupils receiving the several school marks (A, B, C, D, and E) in small sections (20-30) and in large sections (over 30). While the frequency of a given school mark varied somewhat as between large and small classes and as between one high school subject and another, Davis was clearly forced to the conclusion that the size of the class has little or nothing to do with term marks.

The second study by Davis dealt with the term marks made by pupils organized into loosely controlled groups. In twenty cities well distributed as to size and location, 6,130 high school pupils

[7] This represents practically the prevailing elementary-school class size the country over. For other evidence on the tendency of teachers to favor existing conditions, see the findings of Metzner and Berry, p. 31.

were organized into small, medium, and large classes. There were 65 small, 120 medium-sized, and 55 large sections. For nine weeks the pupils were given, as far as possible, identical instruction. At the end of that time tests were given and mid-semester marks assigned. The same slight variations were found in the frequency of A's, B's, etc. as between classes of various sizes and as between school subjects that were noted in the first study; but the inevitable general conclusion was the same—"the effectiveness of a high school class, in so far as the achievement of pupils is the objective, is chiefly determined by factors other than size."

Davis' study, due to its geographical scope and consequent difficulty of coordination, so lacked in control of the various factors which are supposed to affect instruction as to render its results of probable limited validity. It deserves attention not because of refinement of procedure but because of the auspices under which it was conducted.

One of the schools which participated in Davis' investigation was the Grand Junction, Colorado, High School. The teachers (60) in that school became so engrossed in the experiment that at the end of the nine weeks they decided to continue it throughout the remainder of the school year. The project was carried out in junior year English classes and covered grammar, composition, notebook work, outside reading, and various phases of American literature. After grouping their pupils the teachers proceeded with the year's work in the customary way, but resorted to standardized and improvised tests more often than usual in order to secure the needed objective evidence of achievement. The experiment was so informally conducted and involved so many variable factors that the teachers' conclusions are relatively empirical. The sentiment was expressed that English does not lend itself readily to such an experiment but that as a result of their experiences they felt that a class of thirty is about the ideal size.

Mueller (55) during the first semester of 1923 conducted a controlled experiment in two classes in Introductory Psychology at the Worcester, Massachusetts, State Normal School. The groups consisted of twenty and forty students who were taught by the same instructor under as nearly identical conditions and by as nearly the same methods as possible. Thirteen students in the small group

were paired with thirteen in the large class on the basis of intelligence. Efficiency was measured in terms of scores on an objective achievement test. The scores of only the paired students figured in the comparison.

The small class showed a superiority of 17.5 per cent, its average achievement score being 70.3 and that of the large class 58. Mueller concluded that since Edmonson and Mulder[8] found no appreciable difference [in semester averages] between classes of 45 and 109 whereas he, Mueller, discovered a significant difference [in average achievement-test scores] between classes of 20 and 40, the critical point lies somewhere below 45. Mueller cautiously limited the application of his conclusion to the mastery of subject matter, contending that the value of student-teacher contacts and the effect of class size upon the instructor must also be considered in any final judgment on class size.

The conclusiveness of Mueller's results is limited by the small number of cases and by the fact that his pairings were made on the single basis of intelligence. It is also probably unsafe to compare the results of experiments in two entirely different courses in distant institutions. In his interpretations Mueller indulges in hyperbolical and unsupportable conclusions with a lavishness inconsistent with the carefulness of his experimental technique. He asserted, for example, that "a class of 45 students *surely* [all italics are ours] cannot be called a small group. It is *impossible* to use small-group methods—class discussions, individual reports, etc.—with a class of 45 and keep the class actively participating in discussions and get each individual to feel a personal responsibility in each lesson. The lecture method *must* be used largely in a group of this size, and more written work *must* be exacted to insure student participation in the work." With Mueller these are postulates, whereas in reality they are some of the very questions on which other experimenters are attempting to get evidence. Moreover, in view of the success with which McMurry, Kilpatrick, and many others conduct spirited discussion (*not* lecture) classes of several hundred students, Mueller's statements smack of extravagance. They illustrate the common tendency to apply one's own biases and experiences to all instructors.

[8] See p. 29.

The ease with which exaggeration can creep into conclusions is demonstrated by Mueller's declaration that "once an instructor takes on a class of forty-five he might—so far as achievement is concerned—take on *any* number beyond that." Again he asserts that "a student's contacts with the teacher often mean *infinitely* more to his development than the most thorough acquaintance with subject matter." "Any" and "infinitely" are bold words!

Finally, the practical unanimity with which instructors report that large classes are more zestful and inspirational than small ones takes some of the edge off of Mueller's statement that "teachers are not inexhaustible sources of energy who can teach large classes with *the same zest and inspiration* and efficiency as they can smaller ones."

During this same semester Averill and Mueller (42) carried on an experiment in the Training School of the Worcester Normal School. The problem was to determine the effect of class size upon comprehension, appreciation, and speed of reading among fifth-grade pupils, as measured on the Thorndike-McCall Reading Scale. Since the classes contained 12 and 26 pupils, the study was really, as the authors point out, a comparison of a small and a medium-sized class. The pupils were paired as to IQ and were taught by the same teacher and by virtually identical methods. An initial test was given after three weeks and a final test at the end of the semester.

Fifty per cent of the large class and 42 per cent of the small failed to maintain their accomplishment quotients. The average gain in the large class was 6.2 points; in the small class 14.0 points. In both classes the majority of those who failed to reach expectancy were of average intelligence. A majority of the large class and 29 per cent of the small class who exceeded their AQ predictions had IQs below 90. In the large class the greatest gains in AQ were made by the pupils of lowest intelligence. The authors attributed this to the fact that in attempting to reach the mentally retarded pupils, the accelerates were neglected. The authors concluded that "the gain made in reading skill in one-half year by a class of twelve fifth-grade pupils will be 22 per cent greater than the gain made by a class of 26 children of equivalent initial intelligence. If equal residual gains are made throughout the entire elementary-school

period beyond the middle of the fourth grade, the pupils will possess at the time of high school entrance almost exactly twice as great reading ability."

While there was apparently an earnest effort to do justice to the large class, there were too few cases upon which to base dependable conclusions. Moreover, there may be no reason to expect a consistent rate of gain in reading ability from the fourth to the eighth grade. The experiment should be repeated with other classes and by other teachers, the pupils being paired on initial reading ability as well as on intelligence. There should also be greater differences in class size.

The first investigation on the relation of class size to instruction at the university level of which any record has been found is that by Edmonson and Mulder (47) in the University of Michigan. The 154 students who enrolled in the School of Education course entitled An Introduction to High School Problems were divided into sections of 45 and 109. On the bases of intelligence and past experience 43 members of the larger section were paired with the members of the smaller class for purposes of comparison. These 43 students remained members of the large section, however, throughout the course. None of the 154, in fact, knew that the experiment was going on until near its close. In order to secure testimony from the students themselves, well toward the close of the semester five members of the large section who were not paired with the smaller class volunteered to change to the smaller group.

Content and procedure in the two classes were kept as nearly identical as physical conditions and present mastery of technique would permit. The services of an assistant were employed in both classes, although his presence was more evident and his duties more numerous in the larger class. The experiment was conducted in a regularly scheduled and accredited course; consequently the difference in the sizes of the rooms and student groups necessitated some adaptation of instructional procedure. In spite of this, however, the variations were few and slight. One essay was required of each student in both sections. The remainder of the written work was in the nature of objective tests and examinations. All written work was graded by the same assistant.

The authors' conclusions were as follows:

What differences do exist indicate that the small class was slightly superior in the essay work and in the mid-semester examination, while the large-class group excelled in the quizzes and final examination.

What slight differences are revealed [in the semester averages]—four-tenths of a point in the average and 1.4 points in the median—are in favor of the group taught in the large class. The differences in our opinion are too slight to be in any way significant. There is approximately the same range and the same distribution of marks. To all appearances the students in one class obtained, as far as achievement can be measured, just as much as those in the other class.

All of the students in both sections were asked early in the experiment to recall the large and small classes to which they had belonged in the past and to state their opinions of the relative efficiency of those classes. Of the 98 who responded, 51 per cent favored small classes, 14.3 per cent preferred large sections, while 34.7 per cent felt that there was no difference in efficiency. The five students who attended both sections during the experiment unanimously favored the small class.

The authors' general conclusions and observations are worth quoting in full:

First, results in terms of semester averages indicate an appreciable difference in the achievement of the large and small class included in this study. Second, student opinion as noted in the questionnaires on the relative efficiency of large and small classes and on the individual preferences of the students favors, in both cases, the small class. Third, the chief advantages in a small class appear to be more personal contact with the instructor, more chance to participate in the class discussion, and introduction of more varied illustrative material. Fourth, the chief advantages of a large class from the student point of view are the varied opinions gained by contact with so large a group. Fifth, the losses encountered in the large class in this experiment due to poor appointment of the classroom and inability to hear, can undoubtedly be greatly reduced. Sixth, there is no reason to believe that methods cannot be devised to overcome the lack of acquaintance between instructor and student in the large classes, which is the chief objection of the students. Seventh, there is need for more study and experimentation in improving large-class methods in such things as (a) methods of obtaining response from each member of the group; (b) methods of securing personal contact between instructor and class; and (c) methods of maintaining the interest of the entire group in the discussions.

Two unsolved problems suggested by this study are:

1. Do semester averages based on written work measure the major part of the desired educational product of university instruction?

2. Given an assistant to take care of the paper work and routine matters, is the real teaching load of the instructor greatly affected by increasing the size of the class in a discussion or lecture course from forty students to approximately one hundred and twenty?

Henry (20) in 1924 compared the costs of maintaining classes of 44, 45, and 46 pupils in the elementary schools of Chicago. He calculated that approximately $9,712,350 would be saved if the average class size were raised from the present standard of 44 to an average of 46. He concluded that "in view of the reports regarding the achievement of pupils in classes of different size, it is reasonable to assume that the present standard of 44 pupils per class in elementary schools could be raised to 46 without impairing the work of these schools. The financial advantage of this change in policy would seem to warrant recommendation that such changes be made."[9]

In 1926 Metzner and Berry (25) reported a careful experiment with one control group of classes and four experimental groups to determine, if possible, the optimum size of the special classes for retarded Detroit pupils under thirteen-and-a-half years of age. The control group consisted of twelve classes of 22 pupils each, which is the normal size of special classes in the Detroit schools. The experimental groups were as follows:

[9] In September, 1926, the average high school class size in Chicago was raised from 31 to 35. That the justification for this change has not gone unchallenged is evidenced by a radio address by Thomas J. Wilson, representing the Chicago Federation of Men Teachers. The address, as published in the *National League of Teachers Association Bulletin* for April, 1927, characterized the arguments for larger classes as heresies. The speaker's chief contention was that teachers of large classes cannot know their pupils. His arguments were based upon a comparison between classes of 20 and 40 pupils. He reported briefly upon the reactions of 100 high school juniors and seniors to the question, "If you were trying to 'slide through' a subject would you select a large class or a small class?" The pupils are reported to have voted unanimously "a large class." The teachers of one large Chicago high school reported that classes of 20 pupils are much more wieldy than classes of 40.

The address appears to have been based wholly upon opinion and suggests that the questionnaire may have been administered to prejudiced, if not selected, pupils and teachers. That the speaker neither recognized nor wanted to recognize Stevenson's findings in his Chicago investigation is suggested by these concluding statements: "All available evidence shows that the children of the city of Chicago are being deprived of an opportunity for a real education by this systematic packing of the classrooms. Under these adverse conditions the children of Chicago are being graduated rather than educated."

Granting that the change may result in some loss to the pupils, it hardly seems reasonable to assume that an average increase of one or two pupils per class would wholly "deprive" children of "a real education."

Group I consisted of three classes of 15 pupils each.
Group II consisted of three classes of 20 pupils each.
Group III consisted of three classes of 25 pupils each.
Group IV consisted of three classes of 30 pupils each.

The teachers of the various groups were comparable in respect to teaching ability as judged by principals and supervisors. The various groups of pupils were equated as far as possible with respect to chronological age, mental age, achievement in school subjects, language spoken at home, and environmental conditions of the school. No attempt was made, however, to have each class comparable in all respects to the other classes within the same group. This allowed the maximum number of combinations to be exploited. The experiment extended over a period of 180 half days. Progress in school subjects and motor control were measured by the Pressey First-Grade Reading Test, the Stanford Achievement Test, the Ayres Handwriting Scale, and a local motor control test.

The results showed no significant differences in achievement between class sizes except on the Pressey Reading Test where Group IV made a much poorer showing than any other group. The authors concluded that "the results of this experiment show that on the average the classes with an enrollment of 25 pupils made as much progress as those with an enrollment of 15, 20, or 22 pupils."

At the end of the experiment most of the principals and teachers in charge of the experimental sections were found to be of the opinion that 25 or 30 pupils to a class are too many for one teacher to handle successfully. The consensus of opinion was that individual attention is not practicable in such large classes but that they make for increased pupil interest through group stimulation. Apropos of teachers' estimates on the ideal class size, the authors pointed out that "the opinion is almost unanimous that the number is just what it should be as long as it does not exceed the usual number (in this case, 22). But as soon as it increases to 25 or 30 all of the teachers and principals with two exceptions believe it is too large. If the experiment had been made in a city where the usual enrollment in a special class is 18 pupils, we might have found almost unanimous agreement among the teachers that 20 pupils in

a class is too large a number. In other words, the number of pupils a teacher has been accustomed to teach will influence her judgment in regard to the number she might be able to teach.[10] We can scarcely expect teachers and principals to vote for a larger number of pupils in a given type of class when work has been organized for the smaller number. There is evidence to indicate that through organization of pupils into small groups, use of pupil teachers, and a wiser selection of subject matter and methods of instruction, a teacher might handle 25 pupils as easily and successfully as she now handles 15 or 20."

In the experiments thus far reported there has been little effort made to adapt teaching procedures to the size of the class. The primary object has been to measure the success of large classes under conventional small-class methods of instruction. If the large classes showed to a disadvantage, the tendency has been to brand them as failures. In other words, the large classes may have failed because they did not have a fair chance to succeed. In the belief that much may be done toward giving large classes an equal chance, the University of Minnesota High School in 1925 launched experiments in English and geometry. Both were planned to run two years, the first to be spent in exploring and trying out various teaching methods to determine which are best adapted to large classes and which to small classes, the second to be devoted to controlled experiments in which the most promising large-class techniques were to be applied to large classes while small classes were to run simultaneously under the most promising small-class conditions and procedures.

By this program of try-out and refinement Miss Smith (29) evolved large-class techniques that enabled her to bring her English classes of 50 pupils out ahead of the best that she could get her classes of 25 pupils to achieve. During both the preliminary and final years Miss Smith found her large classes to be much more inspiring.[11]

During 1925-26 Haertter (18) determined experimentally his

[10] The maximum number, but not the minimum.—Subcommittee.

[11] Because Miss Smith expects to submit the report of her investigation to the Graduate School faculty of the University of Minnesota in partial fulfillment of the requirements for the degree of doctor of philosophy, a more detailed account of her project is deemed inadvisable here. It must suffice to say that the experiment was controlled with meticulous care.

most successful large- and small-class techniques for teaching geometry in the University of Minnesota High School. His object was to apply these refined procedures in a controlled experiment during the following year. He was able, even during his try-out year, to bring his class of 50 pupils out ahead of the best that he could get his paired class of 25 pupils to accomplish. The salient feature of Haertter's large-class technique was the breaking up of the class into small deliberative groups. After these squads had gone as far with the assignment as they could, Haertter would call them together and help them to clear up their troubles. He found that most of the squads usually experienced the same difficulties, so that he was able to go at once to the specific obstacle and resolve it with a maximum of economy. Under this technique a large classroom was essential and sound class management necessary.

Because he accepted a position elsewhere Haertter was unable to follow up his preliminary year with a controlled experiment. Miss McGuire (24), a colleague, took up the investigation in the fall of 1926. Lest the procedures which Haertter had found most effective might not prove to be her most successful large-class methods, Miss McGuire also devoted her first year to trial experiments. While her large class consistently surpassed her small class, she was not able to use Haertter's most effective large-class techniques. Miss McGuire found her large class more inspiring but more enervating.

In all of the University of Minnesota High School experiments the comparisons were based upon the very best large- and small-class procedures that could be evolved. Pupils were carefully paired on the bases of intelligence, past scholarship, and, in the case of English, reading ability. Achievement was measured by many objective tests. In every case the large class surpassed the small. The other outstanding conclusions are (1) that much can be done in the way of adapting instruction to the size of the class, and (2) that in the final analysis each instructor must determine experimentally his own best teaching procedures.

The only other reported case of studied adaptation of instruction to the class-size situation is that of Trueblood (37) who handles geometry classes of 100 pupils in the Arsenal Technical High School at Indianapolis. Forced to adapt his program to an

ever increasing enrollment, Trueblood gradually evolved techniques for handling classes of 100 pupils without lowering his standards of mastery. This process of evolution covered several years, starting with a normal-sized class and increasing a few each term. The outstanding feature of his perfected class organization is the appointment of an upper-classman to each ten members of his large class. These leaders had been A students in the same course the year before. Their chief responsibilities are to keep each pupil doing his best, to diagnose each one's difficulties as revealed in conferences and daily diagnostic tests, and to keep the instructor informed on the daily progress of each pupil. The leaders serve gratis and consider their appointment an honor. Numerous other economies are salient in Trueblood's teaching.

Preliminary to launching a series of controlled experiments, a committee on class size, appointed by the National Association of Secondary School Principals, sent out in the fall of 1926 a questionnaire to more than six hundred secondary school teachers who had had experience with large classes (40 or more). The chief purpose of the inquiry was to ascertain what methods of instruction and classroom management these teachers had found to be most effective with large classes. Considerable supplementary and supporting information was also elicited.

Briefly, the 192 teachers who responded were preponderately opposed to large classes. Their prevailing reasons were that such classes (1) increase the need for individualized instruction but render the securing of it more difficult; (2) complicate the problems of discipline; and (3) overload the teacher. There was wide diversity of opinion as to the most effective large-class teaching procedures and as to practically every other issue raised by the questionnaire. Hudelson (23 and 36), who conducted the inquiry, concluded that the majority of these teachers were probably incompetent to render a judgment upon which administrators would be warranted in basing a permanent class-size policy because (1) little effort had been made to adapt several important teaching functions to large-class conditions, and (2) the teachers were biased because large classes had usually been imposed upon them with the result that their pupil loads were considerably increased without compensating relief from other duties. The majority of these

teachers apparently desired sincerely to adapt their ministrations to the needs of each pupil; but either they didn't know how to do it in big classes or, knowing, hadn't. Many of them were too heavily scheduled with class and extra-class duties to attempt diagnostic and remedial teaching, even had their classes all been small. The inquiry clearly revealed that the success of large classes depends in no inconsiderable measure upon the leadership, cooperation, and tact of administrators. The responses also indicated that while high school teachers are very skeptical of their ability to adapt instruction to larger classes, they are confident of their ability to modify their teaching to suit smaller classes.

Conclusions

Apparently the nearest one can come to the truth in a single statement is that as a result of such researches as have been conducted, the size of the class has little, if anything, to do with educational efficiency measured in terms of pupil achievement. If there is any difference it is in favor of the small or medium-sized class, and this advantage is slightly more beneficial to dull pupils.

The seeming inconsequence of these conclusions may, however, mask their real significance. If students achieve nearly as well in large classes as in small ones, can the continued maintenance of small classes be justified? Is the slight advantage worth the difference in cost? Are there other important outcomes accruing, or at least accruable, only from small classes that will warrant their inevitably heavier expense? If so, can means be perfected for attaining these outcomes in large-class units and can an adequate number of teachers be trained to employ these means? In brief, if the advantages of small classes are so slight under present methods of instruction and classroom management, can classroom techniques be evolved which will reduce educational costs by producing results favorable to larger classes?

Summary

The following five methods of inquiry have been employed in the United States to determine optimum class size in relation to efficiency of instruction:

1. Administrative efficiency: the relation of results to cost.
   Examples: Almack; Henry.

2. Testimony: the opinions of administrators, teachers, or pupils.
   Examples: Almack (superintendents' and teachers' opinions); Edmonson and Mulder (university students' opinions); Hudelson (high school teachers' opinions); Tope *et al*, (high school English teachers' opinions).
3. Pupil progress.
   A. Comparison of the percentages of pupils promoted.
   Examples: Cornman; Boyer; Bachman; Elliott; Harlan; Davis.
   B. Comparative distribution of school marks.
   Examples: Cornman; Davis; Stevenson (high schools).
4. Achievement.
   A. Comparison of results in classes of varying sizes regardless of pupil-intelligence and measured in whole or in part by subjective and improvised non-standardized achievement tests. Class size the only controlled factor.
   Examples: Rice; Elliott; Breed and McCarthy; Davis; Tope *et al.;* Stevenson (high school); Trueblood.
   B. Comparison of results in classes of varying sizes, with pupils of known intelligence measured by standardized achievement tests.
   Example: Harlan.
5. Controlled experiment: comparison of results in classes of varying sizes, with class size the only variable in so far as feasible.
   Examples: Stevenson (elementary schools): Edmonson and Mulder; Mueller; Averill and Mueller; Metzner and Berry; Haertter; Smith; McGuire.

According to educational levels, the investigations have been as follows:

Universities: Edmonson and Mulder.
Colleges: Mueller.
High Schools: Stevenson (in part); Davis; Tope *et al.;* Trueblood; Haertter; Smith; McGuire; Hudelson.
Elementary Schools: Rice; Cornman; Boyer; Bachman; Elliott; Harlan; Breed and McCarthy; Stevenson (in part); Almack; Averill and Mueller; Henry.
Special Classes: Metzner and Berry (retarded children).

Recapitulation

RICE (56) 1896. Achievement in arithmetic. Grades IV to VIII. Eighteen schools in seven cities. Improvised tests. Conclusions: no relationship between size of class and achievement.

RICE (57) 1896. Achievement in languages. Grades IV to VIII. Nine cities. Improvised tests. Conclusions: no relationship.

CORNMAN (45) 1909. Pupil progress. Three hundred and twenty primary and grammar grade classes in Philadelphia. Small, medium-

sized, and large classes. Scope of study: promotion; monthly reports; pupil conduct. Conclusions: no significant relationships. Recommended elementary school classes of from 40 to 50 pupils, with atypical children segregated in classes of from 15 to 25 for special treatment.

BACHMAN (9) 1911-13. Pupil progress. New York City. Scope of study: similar to those of Cornman and Boyer. Conclusions: only one more promotion per 94 pupils in classes of fifty-and-under than in classes of over fifty.

BOYER (43) 1913. Pupil progress. Ten districts in Philadelphia. Primary and grammar grades. Scope of study: promotion rates. Conclusions: in primary grades the advantage lay with the medium-sized classes; in grammar grades promotion rates decreased as size of class increased. Boyer was not satisfied with promotion rate as a basis of judging teaching efficiency. Recommended derivation of standardized tests for this purpose.

ELLIOTT (17) 1914. Promotion rates; achievement; pupil experience with class size; pupil improvement. Elementary schools of several cities. Classes ranging by fives from twenty or less to over fifty.

1. Promotion rates. No significant relationships.

2. Comparative achievement of fifth- and seventh-grade pupils in composition, spelling, handwriting, arithmetic, and range of vocabulary as measured by improvised tests. Conclusions: in fifth grade larger classes were superior in writing, arithmetic, and composition; inferior in spelling and range of vocabulary. In seventh grade larger classes were superior in composition; inferior in arithmetic, spelling, and range of vocabulary.

3. Comparison of achievement of pupils who had been taught in large classes for at least four years with pupils who had been taught in small classes for four or more years. Scope: composition, arithmetic, spelling, penmanship, and vocabulary. Conclusions: large classes in fifth grade superior in composition and arithmetic but inferior in other subjects. Large seventh-grade classes superior in writing but inferior in the other subjects.

4. Comparative improvement in penmanship and language over 17 weeks. Eighty-three classes in penmanship; 42 in language. Conclusion: "results taken for the sole purpose of studying the improvement made by children show no correlation between class size and attainment."

HARLAN (49) 1915. Promotion rates; voluntary withdrawals; pupil attention; pupil participation; time spent in routine classroom activities; economy of time; attainment in arithmetic. One thousand three hundred and forty-six classes from all elementary grades in 32 cities.

1. Promotion rates. Conclusions: promotion rates uniformly low for all classes of 56 or more pupils. Except for grades II and VIII,

maximum rate of promotion was in the smallest classes, minimum in the largest.

2. Withdrawals. Conclusions: the larger the class, the higher the record of permanent voluntary withdrawals.

3. Pupil attention in class. Conclusion: no relationship to class size.

4. Pupil participation in class. Conclusion: no relationship.

5. Time spent in routine classroom activities. Conclusion: class size not an important factor.

6. Economy of time. Conclusion: small classes seem to waste more time (absolutely) than large classes do.

7. Attainment in arithmetic. Six hundred and seventy-five classes in all elementary grades widely scattered over the country. Measured by a standardized test. Conclusion: "without exception, medium-sized classes are superior to large and small classes in achievement in arithmetic as measured by the Courtis Tests."

BREED AND McCARTHY (44) 1916. Relation of class size to efficiency in the teaching of spelling. Fifty-eight paired elementary school classes. Preliminary test on 80 words; study period of 20 days; final test on same 80 words. Procedure uniform for all classes. Effort made to equate teaching ability. Conclusions: all large classes showed greater percentage of improvement except in grades III and VII. Regular increase in amount of improvement from an enrollment of 20 up to 45; after that, a decrease. Recommended that classes of less than 40 in the elementary school, especially below the seventh grade, be increased to 40 or 45.

STEVENSON (32) 1920-21.

I. Pupil achievement. Controlled experiment with fifty classes in grades II, V, and VII in five Chicago elementary schools. Scope: spelling, word recognition, arithmetic, understanding of sentences, silent reading, and language. Each large class paired with small one on bases of intelligence, teacher, and semester. Standardized achievement tests given at beginning, middle, and end of year.

1. Relation of size of class to achievement. Conclusion: "The size of classes, even when important influences affecting teaching are made constant, seems to determine the result only to a very small degree. . . . Children in higher grades profit rather more by small classes than do children in the lower grades."

2. Relation between class size and intelligence. Improvement of 211 bright, 360 average, and 312 dull pupils in grades II, V, and VII compared. Conclusions: "Small classes were, in general, of greatest advantage to the dull pupils." Pupils of average ability profited about the same, whether in large or small classes. "All the advantage of the small class is brought about by the presence of dull pupils."

3. Class size and achievement in reading. Conclusion: "If there is any definite conclusion with regard to reading, it is that rate increases in

the larger classes while comprehension is unaffected." Limitation of Stevenson's Chicago elementary school experiment: the small differences in size between the large and small classes.

II. Comparison of class size with class work and final examinations of 2,821 pupils in 134 Chicago high school classes. Conclusions: "The sixteen teachers seem to be able according to their own ratings to teach 600 high school pupils about as efficiently as they do one-half that number." Small classes were found to be slightly favorable to pupils of average intelligence, a little less favorable to dull pupils, and somewhat least favorable to bright pupils. Recommendations: (1) that pupils' special abilities, particularly in college classes, be used as a partial criterion in classifying them into equal-ability groups; and (2) that the ability of teachers be taken into consideration in making comparisons of the results of class size upon teaching efficiency.

STEVENSON (34) 1922(?). Pupil progress. A comparison of examination marks and term averages of large and small high school classes in Lynn, Massachusetts, Covington, Kentucky, and Grand Rapids, Michigan. Scope: algebra, Latin, ancient history, United States history, and English II. Experimental technique similar to, and results supplementary to and confirmatory of, those of his Chicago high school study. Smaller classes showed an advantage of 1.6 points on average examination mark and of half of one point on term averages. Small classes were also slightly superior in average intelligence.

STEVENSON (35) 1923-24(?). Controlled experiments with 1,129 pupils in large and small heterogeneous classes in grades II, V, and VII in Akron, Cincinnati, Cleveland, and Toledo. Conditions and technique similar to those of Stevenson's Chicago elementary school study except that differences in class size were significant in present investigation. Results varied as between subjects and grades. In all subjects and grades combined, there was no significant advantage either way. In grade II advantage shifted from large to small classes when size was increased from 43 to 45. In grade V diminishing returns were not apparent in classes up to 48 in size. In grade VII the advantage in favor of large classes maintained for groups as large as 45.

ALMACK (41) 1921-22.

1. Comparison of pupil attainment in large and small classes. Training School of Teachers College, San José, California. Pupil intelligence constant. Subject matter varied, as probably did teaching ability. Conclusion: "Results are independent of the size of the class."

2. Testimony. Opinions of 1,088 superintendents and experienced elementary school teachers on the optimum size of class in relation to instruction, discipline, and demand upon the energy of the teacher.

Conclusion: modal opinion was that average results may be expected from classes of 36 pupils.

3. A plan for computing the optimum size of classes in terms of the ratio between taxable resources and school costs, based upon median standards of cost and pupil achievement. A size-of-class and efficiency index is derived for the elementary schools in 196 cities with a population exceeding 30,000. Conclusions: (1) For these cities, costs most nearly equal results in classes enrolling 38 pupils; and (2) "No city with its present wealth can maintain elementary classes with fewer than 25 pupils without exceeding the median tax rate."

DAVIS (46) 1922. Comparative results of class sizes in the accredited high schools of the North Central Association.

1. Percentage distribution of the various school marks (A, B, C, D, and E) in small and large classes for the school year 1921-22. Conclusion: the size of the class has little or nothing to do with term marks.

2. Comparison of school marks in 65 small, 120 medium-sized, and 55 large classes after a nine-week period of somewhat uniform instruction. Six thousand one hundred and thirty high school pupils in twenty widely distributed cities. Improvised tests were given after nine weeks, and mid-semester marks assigned. Conclusion: the effectiveness of a high school class, in so far as the achievement of pupils is the objective, is chiefly determined by factors other than class size.

TOPE *et al.* (60) 1922-23. Davis' study (part 2) somewhat refined, controlled, and extended throughout the remainder of the school year. English in junior year of Grand Junction, Colorado, High School. Improvised and standardized tests employed. Conclusions (largely empirical): (1) English does not lend itself readily to such an experiment because of preponderance of subjective and discursive elements, and (2) thirty is felt to be about an ideal class size.

MUELLER (55) 1923. Comparative achievement in large and small classes in Introductory Psychology in Worcester, Massachusetts, State Normal School. One semester. Classes of 20 and 40 students. Thirteen students in each class, paired as to intelligence, were measured by an objective achievement test. Conclusions: small-class average score, 70.3; large, 58. By comparing his results with those of Edmonson and Mulder, Mueller deduced that the critical point in class size is somewhere below 45.

AVERILL AND MUELLER (42) 1923. Effect of class size upon efficiency of instruction in fifth-grade reading, as measured on the Thorndike-McCall Reading Scale. Training School of the Worcester, Massachusetts, Normal. One semester. Classes of 12 and 26 pupils paired as to intelligence and taught by the same teacher and methods. Conclusions: average gain in AQ in small class, 14 points, in large,

6.2 points. Negative correlation between intelligence and gain in reading, especially in larger class.

EDMONSON AND MULDER (47) 1923.

1. Controlled experiment in a teacher-training course in the University of Michigan to determine the relation of class size to efficiency of university instruction. Sections of 45 and 109. Forty-three in each class paired as to intelligence and past experience. Every factor except class size controlled as far as possible. Same assistant for both classes. One essay; all other measurements made with objective tests. Conclusions: "To all appearances the students in one class obtained, as far as achievement can be measured, just as much as those in the other class."

2. Pupil testimony. Fifty students favored small classes, 14 preferred large classes, and 34 were indifferent. Chief reasons for preferring small class: (a) more personal relationship with instructor, and (b) more chances to make contributions in class. Chief argument for large class: more opportunity for exchange of students' views.

3. Five students voluntarily divided their time between the two classes. All favored the small section.

HENRY (20) 1924. Comparative costs of maintaining classes of 44, 45, and 46 pupils in the elementary schools of Chicago. Conclusion: nearly ten million dollars could be saved by raising the average class size standard from 44 to 46.

METZNER AND BERRY (25) 1925-26. Optimum size of special classes for mentally retarded children under 13.5 years of age in Detroit, Michigan. Twelve control sections of 22 pupils each (22 being the normal size of special classes in Detroit); three experimental sections of 15 pupils each; three of 20 pupils each; three of 25 pupils each; and three of 30 pupils each. Experiment extended over 180 half days. Teachers paired on ability; pupils on mental age, chronological age, past school record, and environmental conditions. Pupils tested on school subjects and motor control. Conclusions: on the average, classes of 25 made as much progress as classes of 15, 20, and 22. The classes of 30 fell down badly in reading.

TRUEBLOOD (37) 1925-26. Experimentally evolved technique for handling geometry classes of 100 pupils in the Arsenal Technical High School, Indianapolis. Outstanding feature of his technique: a pupil helper for each ten members of the large class. Helpers were superior students in geometry the year before. They eagerly serve gratis. Trueblood is able to handle classes of 100 without lowering his standards of mastery. His technique has been evolved gradually over a period of several years, taking a few more pupils each year. He practices numerous teaching economies.

HAERTTER (18) 1925-26. Controlled experiment to determine his most effective small- and large-class techniques for teaching geometry in the University of Minnesota High School. One year. He was able, even in this preliminary, try-out year, to bring his class of 50 pupils out ahead of the best that his paired class of 25 pupils could do, as measured by numerous objective tests of achievement.

SMITH (29) 1925-27.

1. A year of preliminary try-outs to determine her most effective small- and large-class techniques for teaching English in the University of Minnesota High School.

2. A second year devoted to a carefully controlled experiment in which her most effective large-class methods were employed in a class of 50 pupils and her best small-class techniques were followed in a paired class of 25 pupils. Numerous objective measurements of achievement were taken. Conclusions: (a) large class consistently excelled small class, and (b) large class was more inspirational than small class.

McGUIRE (24) 1926-27. One year of controlled experiments to determine her most effective small- and large-class techniques for teaching geometry in the University of Minnesota High School. Preliminary to a follow-up experiment employing her best methods. Conclusions: (a) even in the preliminary year her large class consistently excelled her small class, and (b) large class more inspirational but more enervating. Was not able to succeed with the techniques that Haertter had found most efficient in his large class, but was able to evolve successful large-class procedures of her own.

HUDELSON (23 and 36) 1926-27. Testimony. Questionnaire returns from 192 experienced large-class high school teachers from all over the country. Purpose of inquiry: to ascertain what these teachers had found to be the most effective and the least effective small- and large-class techniques of instruction and classroom management; to discover their class-size preferences and their reasons therefor; and to learn to what extent they had attempted to adapt their instruction to the size of the class. Considerable supplementary information was also elicited. Conclusions: (a) teachers decidedly prefer small classes, although willing to tackle large classes if they are furnished assistance; (b) large classes unsatisfactory because they overload the teacher, render discipline more complicated and difficult, and complicate individualized instruction; and (c) these teachers have neglected many opportunities of adapting their teaching to large-class conditions. They are at wide variance as to the most effective and least effective small- and large-class teaching procedures. The prevailing argument in support of large classes is that more varied pupil views are possible.

Conclusions

An analysis of the results of all previous investigations leads to the conclusion that, by and large, class size is not a critical factor in educational efficiency, measured in terms of student achievement. If it is likely that certain courses are peculiarly adapted to small classes, it is equally probable that the purposes of other courses can best be realized in large classes. Teachers probably vary in their ability to handle large and small classes; therefore each teacher should determine experimentally his optimum class size. Any change in class-size policy should be carefully prepared for before it is put into effect, for at best the necessary adaptations can be made but slowly.

CHAPTER III

TRENDS IN ADJUSTMENT TO INCREASED ENROLLMENT

The tide of popular interest in higher education is taxing our institutions to the limit. Its cumulative effect is shown in Table V. The total enrollment in colleges, universities, and professional schools has increased from slightly over 120,000 in 1890 to approximately two-thirds of a million in 1924.[1] During the last ten years alone the enrollment has more than doubled.

If this were a mere wave destined soon to recede, temporary adaptations might suffice; but the fact that the surge shows no signs of ebbing has precipitated upon universities the necessity of permanently adjusting themselves to the new conditions. The most obvious and expeditious solution would be to increase the size of the teaching staff. That this has been resorted to is indicated by Table VI, which shows that the number of teachers has increased 350 per cent since 1890. A comparison of Tables V and VI, however, leads to the conclusion that increase in staff has not been the only step taken. The average students-per-teacher ratio has increased from 9.22 to 1 in 1890 to 11.34 to 1 in 1925. In other words, the increase in teaching personnel, though significant, has lagged behind the enormous increase in student enrollment. The comparative trends are portrayed in Figure 2. In view of the costs involved, the amazing fact is not that staffing has lost ground but that it has been so well able to maintain its relative position.

The Situation at Minnesota

In common with sister institutions, the University of Minnesota has been overtaken by the tide of increased enrollment. The flood did not, however, come wholly without warning. As early as 1920 serious attention was given to forecasting the probable extent of the movement. In that year a portentous study[2] was

[1] United States Bureau of Education Bulletin, 1926, No. 19, Table 6, p. 6.

[2] L. V. Koos and R. M. West. *Growth of the University in the Next Quarter Century.* Report of the Survey Commission No. I (University of Minnesota Press, 1920).

issued, from which Table VII is drawn. Even a conservative estimate placed the probable enrollment, exclusive of extension and correspondence courses, at 21,000 in 1930, 26,000 in 1935, 31,000 in 1940, and the truly appalling figure of 37,000 in 1945. These predictions were proposed as bases for estimating the necessary adjustments in staff, buildings, and equipment at five-year intervals for the next quarter century.

TABLE V

Total Enrollments and Trend of Enrollment in Colleges, Universities, and Professional Schools (Excluding Preparatory Students), 1890-1924

Year	Total Enrollment*	Per Cent of Increase (Base, 1890)	Per Cent of Increase over Preceding Period
1924	664,266	445	44
1920	462,445	279	53
1915	303,233	149	14
1910	266,654	119	34
1905	199,045	63	18
1900	167,999	38	16
1895	144,706	19	19
1890	121,942		

* United States Bureau of Education Bulletin, 1926, No. 19, Table 6, p. 6.

TABLE VI

Total Number of Teachers in Colleges, Universities, and Professional Schools, 1890-1924

Year	Number of Teachers*	Per Cent of Increase (Base, 1890)	Per Cent of Increase over Preceding Period
1924	58,528	343	29
1920	45,531	245	30
1910	35,114	166	49
1900	23,574	78	78
1890	13,216		

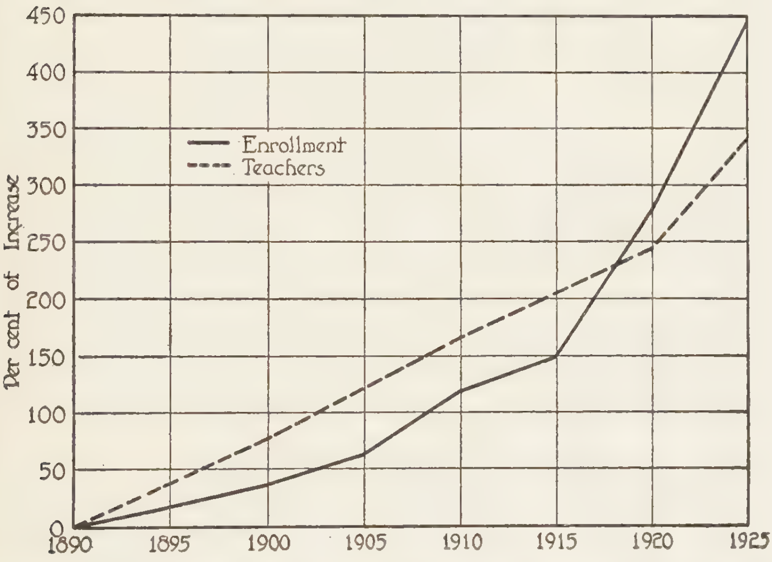
* United States Bureau of Education Bulletin, 1926, No. 19, Table 5, p. 5.

Adjustment to rapidly growing enrollment is closely bound up with the matter of staffing and funds. As may be seen in Table VIII, figures drawn from the Comptroller's annual reports show that although the total enrollment in the University of Minnesota

had by 1926 increased 35 per cent over that in 1921, total disbursements during the same period had increased only 26 per cent. The same reports also reveal considerable variance among the different units of the University in the relative ratios of increase during the same period. While gross enrollment may not by itself furnish an accurate gauge of relative instructional effort as between units, the comparative trends in enrollment and disbursement for a given unit do provide a rough but significant index. The data

FIGURE 2

Comparison of the Percentage of Increase in Student Enrollment and Number of Teachers in Colleges, Universities, and Professional Schools of the United States, with the Year 1900 as a Base



show (1) that, on the whole, increase in total disbursements has lagged behind growth in enrollment, and (2) that, apart from the general increase, there has been very little relationship between the two rates of increase in a given unit. These facts suggest that the major adjustments to the problem of increased enrollment at Minnesota may not always have been effected through enlargement of teaching staff, especially in the units having the greatest growth. The probability that the adaptation may have in part been effected

by increasing the average teacher-load, either by assigning more classes per instructor or by increasing the average size of classes, suggested the first unit of the present investigation.

TABLE VII

SUMMARY OF ESTIMATED GROWTH IN ENROLLMENT AT THE UNIVERSITY OF MINNESOTA*

	1919-20	1924-25	1929-30	1934-35	1939-40	1944-45
I. Collegiate enrollment						
a. Undergraduate	7,089	8,300	10,000	11,500	13,300	15,000
b. Graduate (exclusive of Mayo Foundation)	283	460	550	640	740	830
c. Summer Session	1,521	2,000	2,400	2,800	3,300	3,700
Total collegiate	8,893	10,760	12,950	14,940	17,340	19,530
II. Non-collegiate enrollment						
a. Subcollegiate	1,782	2,000	2,400	2,800	3,300	3,700
b. Short courses	3,000†	4,200	6,000	8,500	11,000	13,700
Total non-collegiate	4,782	6,200	8,400	11,300	14,300	17,400
III. Total enrollment, exclusive of extension and correspondence school courses	13,675†	16,960	21,350	26,240	31,640	36,930
IV. Reduced to basis of 36 weeks' students	9,000†	10,600	12,800	14,840	17,330	19,500

* Table reproduced from Koos and West, *Growth of the University in the Next Quarter Century*, p. 50.

† Estimated total. Registration for 1919-20 not complete.

TABLE VIII

COMPARISON OF PERCENTAGE TRENDS OF TOTAL STUDENT REGISTRATION AND OF TOTAL DISBURSEMENTS, UNIVERSITY OF MINNESOTA, 1921 THROUGH 1926 (1921 used as a base)*

YEAR	TREND IN ENROLLMENT	TREND IN TOTAL DISBURSEMENTS
1926	135	126
1925	125	123
1924	119	120
1923	116	118
1922	108	116
1921	100	100

* Data drawn from Comptroller's annual reports.

CHAPTER IV

THE CLASS-SIZE SITUATION AT MINNESOTA

Average Size of Classes by Colleges

In the previous chapter attention was called to the decided increase in total student enrollment at the University of Minnesota during the past six years. It was demonstrated that this increase was more decided in some colleges than in others. Table IX throws further light on this point. It shows for the fall quarters of 1920 and 1925 the total number of classes and the average size of classes in all courses numbered less than 200 in typical colleges, including the most rapidly growing and the least rapidly growing colleges in the University. The number of classes taught has increased in every case except in the College of Pharmacy where it has remained stationary. The policy of maintaining sectioned courses and of setting more or less definite limits on the size of each section seems to be reflected in the table.

In spite of the increase in total enrollment, only the Colleges of Pharmacy and Education show a decided increase in the average size of classes. The fact that neither of these colleges has populous freshmen courses probably has a distinct bearing on the matter, since it is in these courses that sectioning is most often practiced. Practically all of the colleges have partially met the influx of students by increasing the total number of classes.

TABLE IX

Comparison of Number and Average Class Size in All Courses Numbered below 200 in Selected Colleges in the University of Minnesota during the Fall Quarters of 1920 and 1925*

School or College	Fall Quarter, 1920				Fall Quarter, 1925			
	Courses 1-99		Courses 100-199		Courses 1-99		Courses 100-199	
	No. of classes	Av. size	No. of classes	Av. size	No. of classes	Av. size	No. of classes	Av. size
S. L. and A.	462	30.2	99	10.1	585	32.8	108	16.4
Education	38	17.1	28	10.6	73	28.5	21	26.3
Engineering	133	22.4	56	18.1	165	24.2	91	16.2
Business	60	30.0	14	32.5	56	26.5	23	30.8
Pharmacy	10	33.5	....	......	10	41.5	....	......
Mines	17	26.9	5	9.5	6	11.7	19	11.2

* Data taken from class reports in Registrar's office.

The distributions of classes by size for the two most rapidly growing divisions, Business and Education, are given in Tables X and XI. The two colleges appear to have adopted exactly opposite policies. Whereas the School of Business Administration seems to desire to hold class size at the same level as in 1920, the College of Education apparently has established a fairly definite policy of increasing the size of the class wherever feasible.

TABLE X

DISTRIBUTION OF CLASSES BY SIZE IN COURSES NUMBERED 1-99 AND 100-199 IN THE SCHOOL OF BUSINESS ADMINISTRATION, FALL QUARTERS, 1920 AND 1925

Number of Students	Frequency			
	1920		1925	
	1-99	100-199	1-99	100-199
1-4	0	1	0	2
5	0	1	3	0
10	2	1	3	0
15	5	3	4	5
20	6	2	12	2
25	22	0	22	3
30	8	1	6	0
35	9	2	2	5
40	7	0	3	2
45	0	0	0	1
50	1	0	0	2
55	0	0	0	0
60		1		1
70	0			0
80		1		
90	0			0
100			1	
125		0		
150		1		
Total number of classes	60	14	56	23
Average size	30.0	32.5	26.5	30.8

AVERAGE SIZE OF CLASSES BY COURSES

To probe the matter a little more deeply, a study was made of the average size of classes in the fall quarter for a considerable array of undergraduate courses wherein the numbers of students

enrolled were large enough to permit sectioning. Special effort was made to include some of the larger courses maintained primarily for freshmen. The fields investigated are Economics, Engineering, Mathematics, English, French, German, History, Psychology, and Sociology. Twenty-eight separate courses are included, representing three colleges—Business, Engineering, and Science, Literature, and Arts. The trend in average size over the seven-year period, 1920 through 1926, is shown in Table XII.

TABLE XI

DISTRIBUTION OF CLASSES BY SIZE IN COURSES NUMBERED 1-99 AND 100-199 IN THE DEPARTMENTS OF EDUCATIONAL ADMINISTRATION, EDUCATIONAL PSYCHOLOGY, HISTORY AND PHILOSOPHY OF EDUCATION, AND THEORY AND PRACTICE, COLLEGE OF EDUCATION, FALL QUARTERS, 1920 AND 1925

Number of Students	Frequency			
	1920		1925	
	1-99	100-199	1-99	100-199
1-4	1	7	3	0
5	3	3	2	2
10	2	2	2	3
15	1	5	6	3
20	1	2	1	2
25	1	0	1	1
30	3	0	0	0
35	1	2	1	2
40	0	0	0	0
45	1		1	1
50			0	1
60			0	1
70			5	1
80			1	
90			1	
100			2	
125			0	
150			0	
175			0	
200			0	
225			1	
Number of classes	14	21	27	17
Average size	17.9	13.0	37.0	27.8

In sixteen of the twenty-eight courses little or no tendency either way is discernible. There are, it is true, variations from one year to another, but on the whole this fluctuation seems to be fortuitous rather than to be due to a consistently maintained policy of class size. The usual response to increased enrollment is an increase in the number of sections scheduled.

TABLE XII

NUMBER AND AVERAGE SIZE OF SECTIONS IN REPRESENTATIVE COURSES WHERE SECTIONING IS OPERATED, UNIVERSITY OF MINNESOTA, 1920-26

A. Number of sections taught. B. Average size of sections.

Course		Classes in the Fall Quarter Of						
		1920	1921	1922	1923	1924	1925	1926
English								
Freshman English Af	A	46	50	42	44	35	38	44
	B	25.1	24.7	26.0	28.9	26.7	29.7	27.5
English Survey 1f	A	3	4	6	3	4	4	7
	B	33.3	37.0	30.0	57.7	39.3	45.0	36.4
Comp. Tech. 4f	A	9	5	6	6	10	12	12
	B	21.3	24.0	21.2	21.5	24.2	26.5	29.2
Chaucer 6f	A	1	2	2	3	4	4	5
	B	34.0	27.0	38.5	35.7	34.5	33.3	24.8
Shakespeare 8f	A	1	2	2	3	4	4	5
	B	76.0	63.0	66.0	53.3	37.3	35.5	33.4
French								
Beginning French 1f	A	10	10	8	9	9	9	11
	B	35.1	31.0	33.1	27.4	30.8	31.8	32.0
Intermediate French 3f	A	7	5	7	9	6	7	7
	B	38.6	39.4	28.6	26.6	29.2	28.9	34.7
Intermediate French 4f	A	4	5	4	4	3	4	4
	B	28.0	21.6	20.5	21.8	27.0	25.8	28.8
German								
Beginning German 1f	A	4	5	6	8	8	10	12
	B	32.0	32.5	35.5	27.3	27.9	29.8	24.8
Rapid Reading 4f	A	2	3	3	3	4	4	5
	B	23.0	30.3	25.3	23.0	21.0	24.5	21.6

TABLE XII—*Continued*

NUMBER AND AVERAGE SIZE OF SECTIONS IN REPRESENTATIVE COURSES WHERE SECTIONING IS OPERATED, UNIVERSITY OF MINNESOTA, 1920-26

Course		Classes in the Fall Quarter of						
		1920	1921	1922	1923	1924	1925	1926
Mathematics								
Higher Algebra 1f	A	7	7	7	(None listed)			
	B	29.4	30.3	30.0				
Alg. & Trig. 4f	A	(None listed)			3	3	3	3
	B				23.7	26.0	27.0	37.0
Higher Algebra 5f	A	(None listed)			4	4	4	4
	B				41.0	34.6	40.8	54.5
Trigonometry 6f	A	7	5	5	2	1	2	2
	B	25.7	30.4	30.4	35.5	66.0	42.5	37.5
Commercial Algebra 8f	A	1	1	2	1	3	3	3
	B	20.0	47.0	27.0	114.0	32.3	27.7	31.0
Engineering Math.								
Higher Algebra 9f	A	3	5	4	9	7	6	12
	B	28.7	21.8	22.8	19.8	22.0	29.7	24.4
College Alg. M.&M. 11f	A	11	14	10	9	8	12	....
	B	27.7	20.0	21.6	21.0	24.9	21.6	....
Materials-Test. Lab. 141f	A	6	6	3	3	5	4	4
	B	25.3	19.2	18.7	24.0	13.2	12.3	11.0
History								
Modern World 1f	A	12	11	12	19	20	20	20
	B	29.2	31.5	33.7	28.4	30.5	33.9	32.3
England 4f	A	6	6	6	7	6	8	8
	B	33.3	32.7	33.3	31.8	33.0	28.8	35.0
Sociology								
Intro. to Sociol. 1f	A	5	7	8	9	10	8	11
	B	61.0	34.4	32.3	42.8	38.3	49.5	37.5
Mod. Soc. Reform 6f	A	3	4	4	4	4	4	4
	B	38.7	38.3	32.3	37.0	38.8	46.3	49.3

TABLE XII—*Continued*

NUMBER AND AVERAGE SIZE OF SECTIONS IN REPRESENTATIVE COURSES WHERE SECTIONING IS OPERATED, UNIVERSITY OF MINNESOTA, 1920-26

Course		Classes in the Fall Quarter Of						
		1920	1921	1922	1923	1924	1925	1926
Business								
Economic History 1f	A	20	16	16	16	16	16	17
	B	27.8	25.1	24.9	26.1	23.3	25.3	30.8
Principles of Econ. 4f	A	10	3	5	4	....	8	6
	B	21.2	26.0	22.4	23.5	....	18.0	25.3
Principles of Econ. 8f	A	7	8	7	5	6	5	5
	B	37.3	24.4	25.1	29.2	29.0	29.2	33.3
Accounting 25f	A	10	10	10	10	10	10	10
	B	36.3	23.0	22.2	24.6	23.5	28.0	29.7
Psychology								
General Psychology 1f	A	23	25	19	20	19	21	21
	B	30.4	29.1	30.8	30.2	34.5	32.4	34.0
Intro. to Lab. Psy. 4f	A	5	4	5	5	5	5	5
	B	41.2	38.7	40.6	38.4	44.4	48.2	48.0

In six of the twenty-eight courses a more or less definite trend toward smaller average classes is evident. These courses are Chaucer 6f, Shakespeare 8f, Beginning German 1f, Rapid (German) Reading 4f, Materials-Testing Laboratory (Engineering) 141f, and Introduction to Sociology 1f. These are the courses where, in general, the number of sections is patently increasing with the enrollment.

On the other hand, in six of the twenty-eight courses there is perceptible a definite trend toward increase in average class size. These courses are Composition for Technical Students 4f, Algebra and Trigonometry 4f, Higher Algebra 5f, Trigonometry 6f, Modern Social Reform 6f, and Introduction to Laboratory Psychology 4f. These are the courses where, it seems, a definite number of sections is scheduled and increased enrollment is absorbed by them.

We see, then, three diverse policies: first, that of reducing the average size of the classes by scheduling additional sections; second, that of holding the average size constant through provision

for overflow classes only; and, third, that of holding the number of sections constant and absorbing the increase in enrollment by enlarging the sections. It is possible but improbable that these tendencies are accidental. It is not within the province of this investigation to determine for any department or course which policy of meeting increased enrollment is preferable; that fact can perhaps best be ascertained by the department itself. The data are here presented to emphasize the variations in practice and to call attention to the need of actual experimentation as a basis for departmental policies regarding class size. If it is likely that instruction in some subjects may require small groups, it would seem to be equally probable that in other subjects the effectiveness of instruction may be no whit impaired by increasing the size of the classes. That this is more than theory is confirmed by the experimental evidence to be presented in Chapter VII.

TABLE XIII

Range in Size of Sections in Representative Junior College Courses Where Sectioning Is Operated, Fall Quarter, 1925

	Student Enrollments					
Course	No. of Sections	Size of Smallest Section	Q_1	Median Size	Q_3	Size of Largest Section
1. Freshman English Af	38	27	29	30	31	39
2. Beginning French 1f	9	24	28	33.	35	44
3. Beginning German 1f	10	24	28	30	30	34
4. Modern World 1f	20	28	31	34	37	40
5. Intro. to Economics 1f	16	22	25	25	26	27
6. General Psychology 1f	21	22	26	30	38	60
7. Intro. to Sociology 1f	8	35	38	48	63	67
8. Higher Algebra 5f	4	34	40	42	44	45
9. College Algebra 11f	12	14	20	21	24	26
10. Principles of Accounting 25f	10	20	25	27	32	37

Opportunities for Experimentation

Each department has a double obligation to meet—to the University and to the student. Duty to the University demands that classes be as large as feasible; duty to the student demands maximum effectiveness. Each department, therefore, is obligated to seek the maximum size of class that, consistent with efficiency, can

be handled. The only reliable approach to the solution of this problem is experimentation.

TABLE XIV

Trend in Average Class Size in the Four Basic Courses in Education, Fall Quarter, 1920-21 through the Winter Quarter, 1926-27

Course	Average Size of Classes						
	1920	1921	1922	1923	1924	1925	1926
Educational Psychology 55	47	81	80	82	101	156	206
Educational Sociology 3	46	65	86	86	99	101	125
History of Education 1	28	37	54	56	93	88	105
Techniques of H.S. Instruction 15	....	....	....	55	70	108	84

That the opportunity for such experimentation exists is clear from Table XIII, which shows the variability in class size in ten sectioned courses for the fall quarter of 1925. Attention is called to the fact that a wide range in size may be found even in courses which are carefully sectioned.

Trend in Selected Courses in the College of Education

While discussing Table XI attention was called to the decided increase in the average size of classes in the College of Education. The four commonly required courses, in which the best opportunity for sectioning may be found, are Techniques of High School Instruction 15, Elementary Educational Psychology 55, History of Education 1, and Educational Sociology 3. The annual enrollment in each of these courses since 1920 was ascertained and the average enrollment for each year is presented in Table XIV. It is at once apparent that in each case there has been an enormous increase. These average annual enrollments would be still greater per section were it not that a number of smaller sections were deliberately organized in the interests of experimentation, some of the results of which will be reported in Chapter VII. The apparent decided decrease in Education 15 is due to the fact that the heaviest enrollment in this course occurs in the spring quarter, which was necessarily omitted in the computations for 1926-27.[1] The most striking growth is in the course in Educational Psychology, which has increased more than fourfold during the seven-year period. The growth in History of Education is almost as marked.

[1] The Education 15 enrollment for the spring quarter of 1926-27 was 152.

FIGURE 3

TREND IN CLASS SIZE IN EDUCATIONAL PSYCHOLOGY 55 OVER SEVEN-YEAR PERIOD, 1920-1927, UNIVERSITY OF MINNESOTA

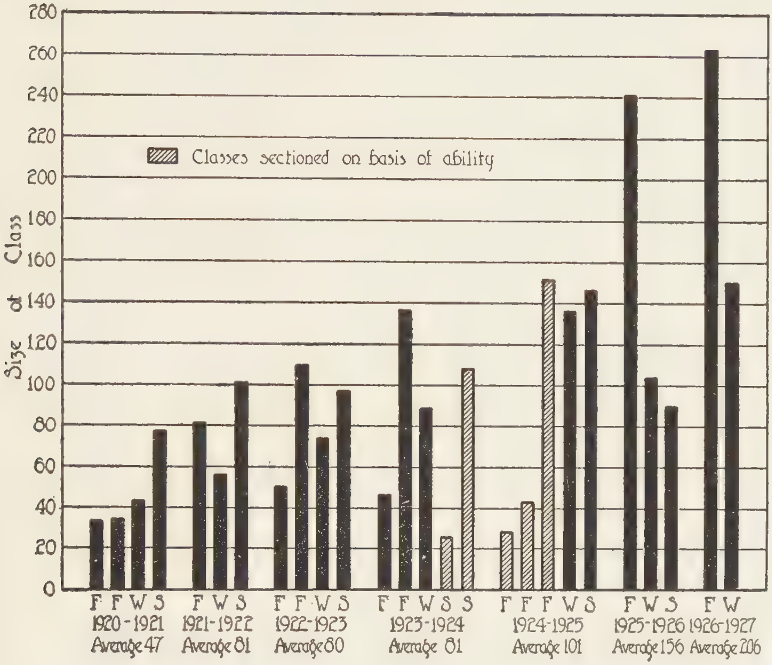


FIGURE 4

TREND IN CLASS SIZE IN HISTORY OF EDUCATION OVER SEVEN-YEAR PERIOD, 1920-1927, UNIVERSITY OF MINNESOTA

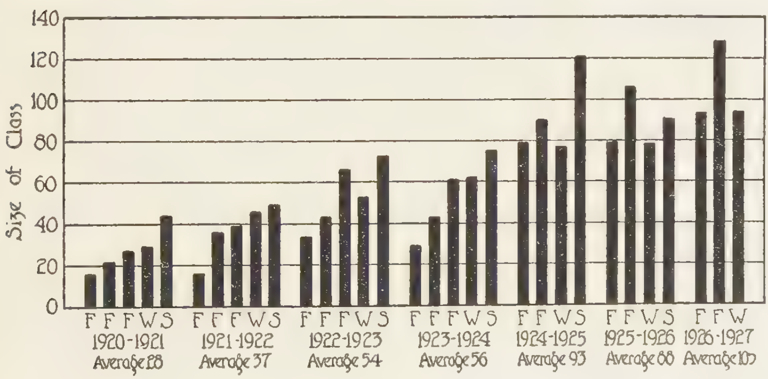


TABLE XV

Percentage Distribution of Marks in Largest and Smallest Classes in Five Freshman Courses at the University of Minnesota, Fall Quarters, 1920-25, Inclusive

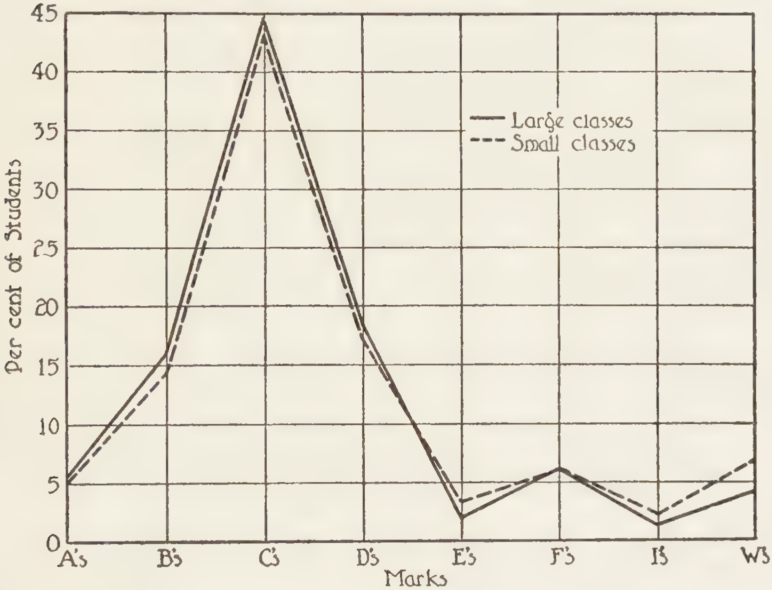
Course	Sec.	No. of Cl.	No. of Students	Av. Cl. Size	Per Cent of Students Marked							
					A	B	C	D	E	F	I	W
General Psychology 1f	L	30	1185	39.5	5.91	16.11	44.89	18.73	2.03	6.24	1.52	4.56
	S	32	811	25.3	5.30	14.53	43.53	17.63	3.45	6.41	2.22	7.03
Modern World 1f	L	24	861	35.9	4.65	19.40	37.86	19.74	3.83	5.46	1.39	7.67
	S	24	602	25.0	5.15	20.93	35.04	18.60	5.15	7.31	1.99	5.81
Beginning French 1f	L	14	519	37.1	6.74	13.49	24.66	16.76	3.08	16.76	1.54	16.96
	S	13	329	25.3	8.51	11.55	22.19	12.16	2.43	24.32	2.13	16.72
Intro. to Sociology 1f	L	12	742	61.8	3.77	18.06	46.63	16.44	0.00	5.53	1.21	8.36
	S	13	334	25.7	5.69	17.37	47.31	14.97	1.50	3.29	1.20	8.68
Economic History 1f	L	23	670	29.1	4.03	19.70	36.42	22.24	4.78	4.33	1.64	6.87
	S	22	489	22.2	4.70	17.38	36.61	16.77	4.70	7.36	3.48	9.00

By "largest classes" is meant those in the highest one-fourth of a distribution of sections of that course, arranged according to size. By "smallest classes" is meant those in the lowest one-fourth in enrollment.

It should be remembered that these are average figures. Variation in the individual classes is still more extreme. Figure 3 presents these facts for Educational Psychology and Figure 4 for History of Education. It is fortunate in cases like these if the increase has been gradual enough so that techniques could be cumulatively adapted to the size of the class.

FIGURE 5

PERCENTAGE DISTRIBUTION OF MARKS IN LARGE AND SMALL CLASSES OF GENERAL PSYCHOLOGY 1F, 1920-1925, UNIVERSITY OF MINNESOTA



	Large classes	Small classes
Number of Sections	30	32
Number of Students	1185	811
Average Size of Classes	39.5	25.3

THE RELATION OF CLASS SIZE TO MARKS

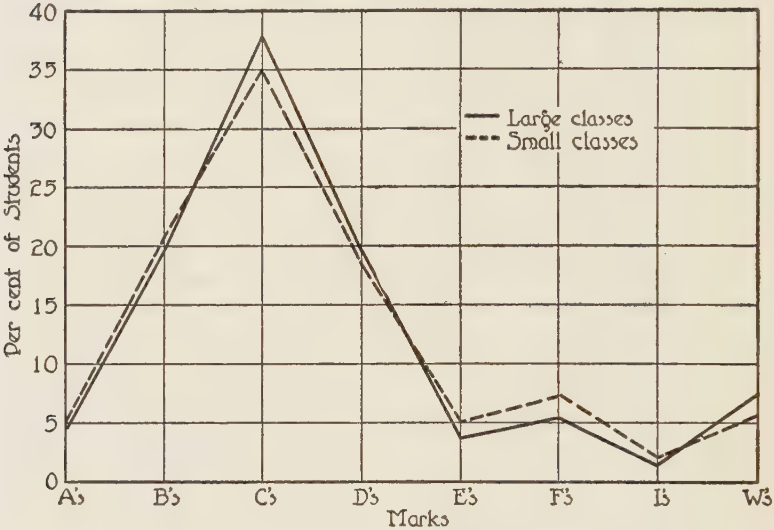
The claim is often made that large classes are not conducive to efficient student work. As reported in a later chapter, 40 per cent of the faculty members signified their belief that large classes increase the proportion of student failures. Students are also in considerable agreement that large classes are least satisfactory

from the standpoint of marks received and that small classes are most satisfactory.

As one approach to the problem, a study was made of student marks in five freshman courses in the University of Minnesota during the fall quarters of 1920 to 1925 inclusive. Courses were

FIGURE 6

Percentage Distribution of Marks in Large and Small Classes of Modern World 1f, 1920-1925, University of Minnesota

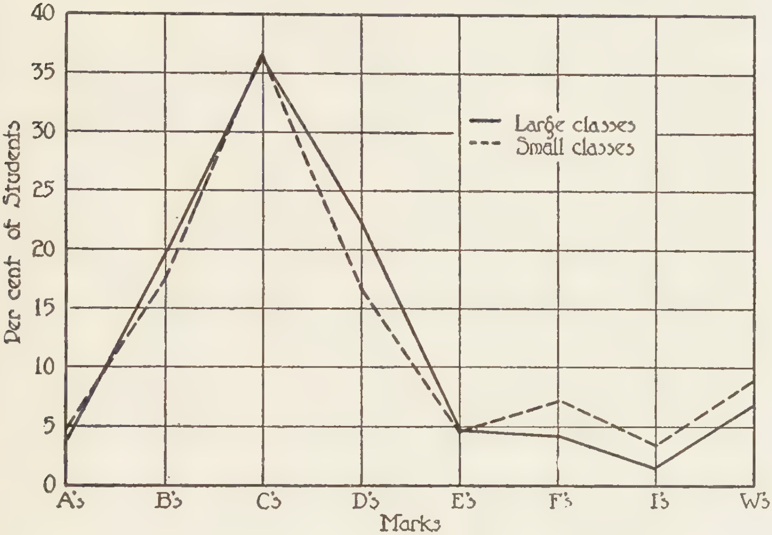


	Large classes	Small classes
Number of Sections	24	24
Number of Students	861	602
Average Size of Classes	35.9	25.0

selected in which a large number of sections might be found. For each year all sections were arranged in order of size. The sections in the highest one-fourth in enrollment were considered "large" classes and those in the lowest one-fourth of the distribution were called "small" classes. Then the actual distribution of marks throughout the six years for all large and for all small sections

FIGURE 7

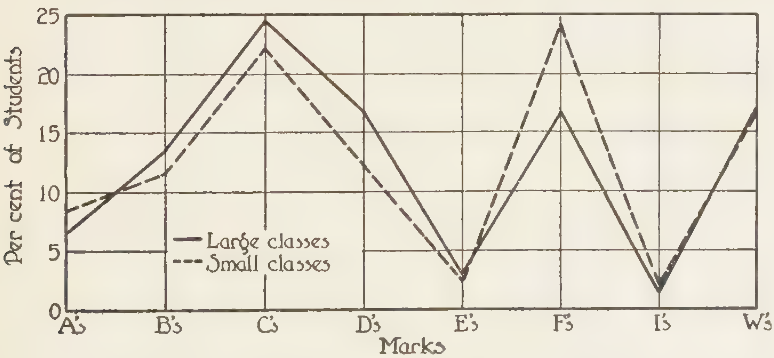
PERCENTAGE DISTRIBUTION OF MARKS IN LARGE AND SMALL CLASSES OF ECONOMIC HISTORY 1F, FOR THE FALL QUARTERS, 1920-1925, UNIVERSITY OF MINNESOTA



	Large classes	Small classes
Number of Sections	23	22
Number of Students	670	489
Average Size of Classes	29.1	22.2

FIGURE 8

PERCENTAGE DISTRIBUTION OF MARKS IN LARGE AND SMALL CLASSES OF BEGINNING FRENCH 1F, 1920-1925, UNIVERSITY OF MINNESOTA

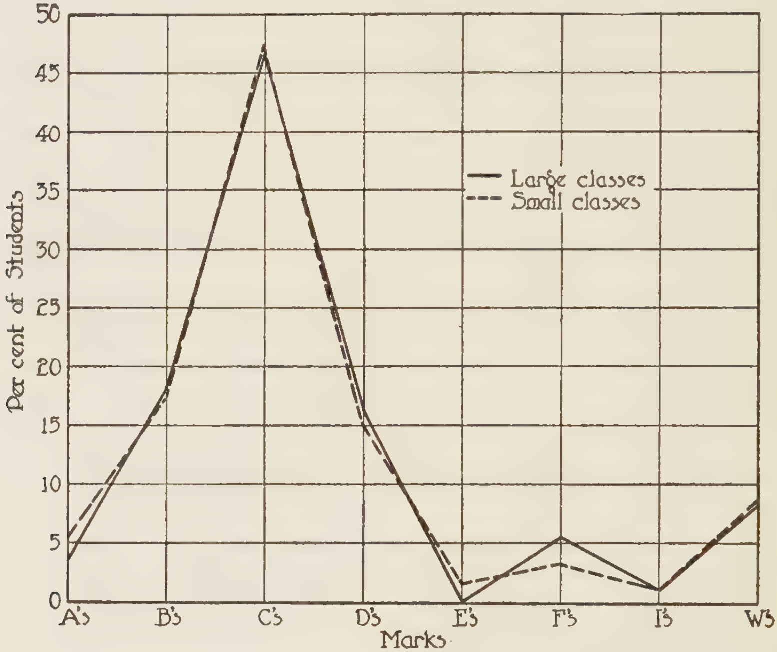


	Large classes	Small classes
Number of Sections	14	13
Number of Students	519	329
Average Size of Classes	37.1	25.3

was determined separately. These distributions, converted into per cents, are displayed in Table XV and in Figures 5 to 10. They represent 6,542 students in 207 sections.

FIGURE 9

PERCENTAGE DISTRIBUTION OF MARKS IN LARGE AND SMALL CLASSES OF INTRODUCTION TO SOCIOLOGY 1F, 1920-1925, UNIVERSITY OF MINNESOTA



	Large classes	Small classes
Number of Sections	12	13
Number of Students	742	334
Average Size of Classes	61.8	25.7

In general there is little difference between the distributions of marks in the large and small sections in any one course. The net advantage is slightly in favor of large classes. The most significant difference occurs in Beginning French 1f, where there is a much larger proportion of failures in the small classes. This is offset to some extent, however, by a somewhat higher percentage of D's in the same course and in Introduction to Sociology 1f.

FIGURE 10

PERCENTAGE DISTRIBUTION OF MARKS IN LARGEST AND SMALLEST CLASSES IN FIVE POPULOUS FRESHMAN COURSES AT THE UNIVERSITY OF MINNESOTA FOR THE FALL QUARTERS, 1920-1925, INCLUSIVE

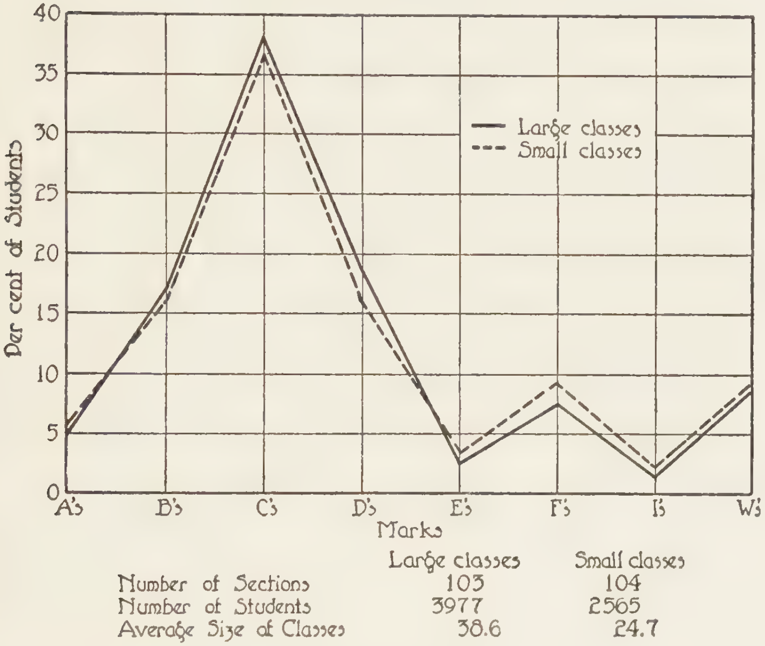


TABLE XVI

PERCENTAGE DISTRIBUTION OF MARKS IN ALL SECTIONS COMBINED OF INTRODUCTORY COURSE IN GENERAL PSYCHOLOGY 1F, DURING THE FALL QUARTER HAVING THE LARGEST AVERAGE SIZE OF SECTIONS AND THE FALL QUARTER HAVING THE SMALLEST AVERAGE SIZE OF SECTIONS; ALSO THE COMPARATIVE EFFECT OF THE LARGEST AND THE SMALLEST SECTIONS DURING THESE SAME YEARS

Year	Sections Presented	No. of Sections	Average Size of Section	Per Cent Distribution of Marks: Pass	E and I	Fail	W
1924	All	19	34.5	85.8	2.0	8.2	4.0
1921	All	25	29.1	79.2	7.1	7.8	5.8
1924	Largest	5	84.4	88.9	1.6	6.2	3.3
1921	Smallest	5	23.8	73.1	6.7	10.9	9.2

There seems to be a slight tendency for the marks in the smaller sections to distribute themselves more widely than in the large sections; that is, there are more failures but also more A's. This is apparent in Modern World, Beginning French, and Economic History. A suggested reason for this is the play of subjectivity on the part of the instructor in determining the final mark for the individual student. The better acquainted the teacher becomes with his students—the most frequent argument offered by both students and faculty in support of the small class—the more disposed he is to allow personality to become a factor in marking. This tendency is recognized and probably exploited by some of the more astute students. Eleven per cent of those who were canvassed listed objectivity of marking as a distinct advantage of large classes. Several elaborated by explaining that they preferred large classes because they felt that each student gets what he earns.

In this connection attention is called in Table XVI to the relative distributions of marks in General Psychology where the final marks are based largely upon objective test results. Here, where the personal factor is properly subordinated, the distributions are almost identical.

In the earlier portion of this chapter attention was called to the wide variation from year to year in the average size of sections in the same course. The significance of this variation will next be presented.

Variations in Class Size

Under the four major heads of "Pass" (including marks of A, B, C, and D), "Conditioned" and "Incomplete" (E and I), "Fail," and "Withdrawn" (canceled without grade and canceled with fail), Table XVI presents the distribution of marks for all sections combined in General Psychology during the fall quarters of 1924 and 1921. The former was the year having the largest average number of pupils enrolled per section, the latter the smallest. The averages were 34.5 and 29.1 students, respectively. This average difference of 5.4 students per section appears small; yet if it be kept in mind that in nineteen sections this would amount to a cumulative total of 102.6 students, or the equivalent of nearly four small sections, the difference becomes of much concern.

A comparison of the percentage distribution of marks shows

that the larger average sections gave a much better distribution than did the average smaller sections. The reader is reminded that probably in no other course in the University of Minnesota are the marks more carefully determined. There is some likelihood, however, that the difference may have been due to a change in departmental policy rather than to class size. This assumption is deduced from the evidence presented in lines 3 and 4 of Table XVI. Instead of 86 per cent "Pass" that characterized all sections combined, the five largest sections yielded 89 per cent; and instead of 8.2 per cent "Fail" for all, the largest sections gave 6.2 per cent. Sections of an average size of 48.4 students gave decidedly the best returns to the students.

Evidence at the other end of the scale is equally convincing. The five smallest sections of the year 1921 showed a much poorer record than did the combined total of the same year, both in per cent passed and per cent failed. Sections of an average size of 23.8 gave decidedly scantier returns to the students than did all of the sections combined.

Lest the situation revealed in Table XVI may have been merely a coincidence, similar data were obtained on the course Modern World 1f. The findings are presented in Table XVII. Here the differences are so slight as to be insignificant either way. The most that can be said is that the economic waste of smaller classes with an average of 5.5 students less per section—a total of 104.5

TABLE XVII

Percentage Distribution of Marks in All Sections Combined of Modern World 1f, during the Fall Quarter Having the Largest Average Size of Sections and the Fall Quarter Having the Smallest Average Size of Sections; also the Comparative Effect of the Largest and the Smallest Sections during These Same Years

Year	Sections Presented	No. of Sections	Average Size of Sections	Per Cent Distribution of Marks			
				Pass	E and I	Fail	W
1925	All	20	33.9	84.0	5.2	5.5	5.3
1923	All	19	28.4	81.0	6.1	5.8	7.1
1925	Largest	5	37.8	84.7	3.7	5.3	6.3
1923	Smallest	5	23.8	81.6	5.2	5.5	7.7

students, or nearly four whole sections—certainly is not justified on the basis of student returns.

TABLE XVIII

PERCENTAGE DISTRIBUTION OF MARKS IN ALL SECTIONS COMBINED OF ECONOMIC HISTORY 1F, DURING THE FALL QUARTER HAVING THE LARGEST AVERAGE SIZE OF SECTIONS AND THE FALL QUARTER HAVING THE SMALLEST AVERAGE SIZE OF SECTIONS

YEAR	SECTIONS PRESENTED	NO. OF SECTIONS	AVERAGE SIZE OF SECTIONS	PER CENT DISTRIBUTION OF MARKS			
				Pass	E and I	Fail	W
1926	All	17	30.8	84.8	5.5	3.0	6.7
1920	All	20	23.3	85.9	3.0	3.0	8.1

Similar data are presented for Economic History (Principles of Economics) for the fall quarters of 1920 and 1926 (Table XVIII). It will be seen that the percentages of failure for the two years are identical. The additional one per cent of students passed in the smaller average group is more than offset by the increased proportion of withdrawals. The increase of 7.5 students in the average size has made little or no perceptible difference in the student marks.

In few subjects are small classes more universally defended and large classes more uniformly condemned than in the field of English. The claim is often advanced that to inspire appreciation, which is one of the aims sought, there must be a close feeling of fellowship between instructor and student and much opportunity for class discussion. To facilitate these conditions small classes are held to be essential.

These claims are not supported by student marks. Table XIX gives for the course English Survey 1f the distribution of marks in the fall quarter of 1922, when the average size of all sections was smallest, contrasted with 1923, when they were largest. Although the average size of classes in 1923 was much larger than in 1922, the distribution of marks is decidedly in favor of the larger sections. Owing to the small number of sections involved, one cannot be sure that this advantage may not have been due to some factor other than class size. With all due allowance for these other factors, however, it is unlikely that the situation

would be reversed; so it is reasonable to believe that large groups have been of themselves no special handicap to English students.

TABLE XIX

Percentage Distribution of Marks in All Sections Combined of English Survey 1f, during the Fall Quarter Having the Largest Average Size of Sections and the Fall Quarter Having the Smallest Average Size of Sections

Year	Sections Examined	No. of Sections	Average Size of Sections	Percentage Distribution of Marks			
				Pass	E and I	Fail	W
1923	All	3	57.7	81.5	3.3	6.9	9.8
1922	All	7	39.8	66.5	5.6	12.3	15.7

TABLE XX

Percentage Distribution of Marks in All Sections Combined of English Literature Af, during the Fall Quarter Having the Largest Average Size of Sections and the Fall Quarter Having the Smallest Average Size of Sections

Year	Sections Examined	No. of Sections	Average Size of Sections	Percentage Distribution of Marks			
				Pass	E and I	Fail	W
1925	All	38	29.7	80.3	8.4	7.4	4.4
1922	All	42	26.0	71.8	9.5	12.3	6.4

TABLE XXI

Percentage Distribution of Marks in All Sections Combined of Higher Algebra 5f, during the Fall Quarter Having the Largest Average Size of Sections and the Fall Quarter Having the Smallest Average Size of Sections

Year	Sections Examined	No. of Sections	Average Size of Sections	Percentage Distribution of Marks			
				Pass	E and I	Fail	W
1926	All	4	54.5	63.8	4.6	10.6	21.1
1924	All	4	34.6	61.3	3.5	12.1	23.1

Effect of Variation in Size upon Classes Sectioned on the Basis of Ability

How does sectioning on the basis of ability affect the achievement of students in classes of varying size? Material similar to that presented in previous tables was gathered for the courses in Freshman English Af. These data are displayed in Table XX. On the face of these returns, homogeneous groups in English achieve much better in large sections than in small ones. An identical procedure applied to Higher Algebra 5f, however, shows no significant difference (Table XXI). It is clear that much more definitely controlled evidence on this question is needed before one can safely attempt to draw conclusions.

Effect of Holding Instructor Constant

Thus far no attempt has been made to match each large class with a smaller class in the same course taught by the same instructor; hence the results have been open to the charge of chance variation due to differences in instructors' standards. To eliminate this factor, data similar to those above were gathered, but quarter, course, and instructor were kept constant, only the size of the class being varied. This was done in two courses in the School of Business Administration, Economic History 1f, and Principles of Accounting 25f.

The findings for the former are shown in Table XXII. The percentage distribution is based upon sixteen large classes and eighteen small[2] classes, a group of each size having been taught by the same instructor. No significant differences can be found, the two distributions being virtually identical.

To determine what effect, if any, laboratory instruction might have, material gathered in the same way was prepared for the more advanced course called Accounting 25f. The data presented in Table XXIII include, over a period of years, eighteen classes of each size under seven different instructors. Whatever differences there are probably must be interpreted as being in favor of the large classes.

[2] In two courses during a given year two small classes were of identical size. To eliminate the effect of selecting the more desirable distribution through an arbitrary selection, both small classes were included in the tabulation.

TABLE XXII

Comparison of Mark Indices and Percentage Distribution of Marks in 16 Large and 18 Small Sections, Taught by the Same Instructor in Economic History 1f

Section	Average Size of Section	Average Mark Index	Percentage Distribution of Marks								
			A	B	C	D	E	I	F	W	WF
Large	33.3	3.52	5.3	20.6	35.8	20.3	3.6	1.7	6.6	4.5	2.3
Small	22.2	3.44	6.8	23.0	34.5	17.0	4.3	2.5	5.8	3.5	2.8

	Pass	E and I	F	W
Large	81.42	5.25	6.57	6.75
Small	81.25	6.75	5.75	6.25

TABLE XXIII

Comparison of Mark Indices and Percentage Distribution of Marks in 18 Large and 18 Small Sections Taught by the Same Instructors in Principles of Accounting 25f

Section	Average Size of Section	Average Mark Index	Percentage Distribution of Marks								
			A	B	C	D	E	I	F	W	WF
Large	33.4	3.53	8.3	21.8	33.1	13.3	3.3	1.5	6.1	10.1	2.5
Small	21.1	3.60	6.6	23.5	35.1	10.0	2.9	2.1	10.0	8.4	2.1

	Pass	E and I	F	W
Large	76.42	4.82	6.14	12.62
Small	75.20	5.01	8.44	11.35

TABLE XXIV

Comparison of Mark Indices and Percentage Distribution of Marks in 12 Large and 12 Small Sections of the Same Advanced English Courses, Taught by the Same Instructors, Fall Quarter, 1921-26

Section	Average Size of Section	Average Mark Index	Percentage Distribution of Marks								
			A	B	C	D	E	I	F	W	WF
Large	75.7	3.38	5.0	24.0	35.7	13.5	4.2	5.0	4.8	5.9	2.0
Small	49.1	3.49	4.3	24.6	38.7	13.6	5.1	3.9	4.3	4.5	1.0

	Pass	E and I	F	W
Large	78.07	9.25	4.76	7.92
Small	81.26	8.96	4.28	5.50

TABLE XXV

COMPARISON OF MARK INDICES AND PERCENTAGE DISTRIBUTION OF MARKS IN 42 LARGE AND 42 SMALL SECTIONS, TAUGHT BY THE SAME INSTRUCTORS IN THE FOUR BASIC COURSES IN EDUCATION 1, 3, 15, AND 55

Section	Average Size of Section	Average Mark Index	Percentage Distribution of Marks								
			A	B	C	D	E	I	F	W	WF
Large	111.7	3.15	7.3	23.1	43.2	15.1	.8	2.2	4.4	3.8	.2
Small	43.9	3.11	6.0	28.3	42.0	11.3	.9	2.6	3.6	5.0	.4

	Pass	E and I	F	W
Large	88.64	2.95	4.43	3.98
Small	87.53	3.47	3.63	5.37

In a search for more evidence on this point, the student marks of all of the classes in the more advanced English courses that could be matched were tabulated. They are presented in Table XXIV. In complete accord with the findings from the previous material, few, if any, significant differences can be found.

Table XXV furnishes similar data on forty-two large and forty-two small classes in four courses taught by eight instructors in the College of Education over a period of six years. It is remarkable how closely the results agree with previous tabulations. A slight tendency toward higher marks for the larger groups is nullified by a slightly higher percentage of failures.

Effect of Class Size upon Mark Indices

To facilitate comparisons a more convenient single index of marks was desired. Since the University of Minnesota uses successive marks as ranks, it was decided to adopt an arbitrary weighting system based upon ranks. Values were assigned as follows:

Mark	A	B	C	D	E	F	I	W	WF
Value	1	2	3	4	5	7	5	6	8

The weight of 5 for an E (condition) and also for an I (incomplete) was based upon the belief that the final grade would in an approximately equal per cent of the cases eventually become a higher mark or revert to an F. The value of 6 was applied to a W (canceled without grade) because, in the opinion of the sub-

committee, the number of cancelations should not be neglected in a study of this kind and a course should be penalized for cancelations, since they usually represent a dead loss in effectiveness of instruction. An extreme weight was given to WF (cancelation with a grade of fail) in the belief that this mark is seldom given unless the student canceling is almost hopeless.

TABLE XXVI

COMPARISON OF AVERAGE INDEX OF MARK EFFICIENCY BETWEEN THE FALL QUARTER HAVING THE LARGEST AVERAGE SECTIONS AND THE FALL QUARTER HAVING THE SMALLEST AVERAGE SECTIONS OVER THE PERIOD 1920 THROUGH 1926

Course and Department Number		No. of Sections		Average Size of Sections		Average Index of Mark Efficiency	
		L.	S.	Largest	Smallest	Largest Section	Smallest Section
1. Eng.	Af	38	50	29.7	24.7	3.49	4.62
2. Eng.	1f	3	6	57.7	30.0	3.76	4.11
3. Eng.	4f	12	6	29.2	21.2	3.84	4.48
4. Eng.	6f	2	11	38.5	24.8	3.21	3.03
5. Eng.	8f	2	14	63.0	33.7	4.15	3.26
6. Fr.	1f	10	9	35.1	27.4	4.46	4.49
7. Fr.	3f	5	9	39.4	26.6	4.40	3.62
8. Fr.	4f	4	4	28.8	20.5	2.61	4.01
9. Fr.	Af	6	12	35.5	24.8	4.16	3.79
10. Fr.	4f	3	4	30.3	21.0	4.06	3.50
11. Math.	4f	3	3	37.0	23.7	4.35	4.44
12. Math.	5f	4	4	54.5	34.6	4.26	4.47
13. Math.	6f	5	2	42.5	30.4	4.19	4.44
14. Math.	8f	3	2	32.3	27.0	4.34	4.67
15. M&M	9f	9	6	29.7	19.8	4.86	5.08
16. M&M	11f	11	14	27.7	20.0	4.24	4.16
17. M&M	141f	6	4	25.3	11.0	2.87	2.56
18. Hist.	1f	20	19	33.9	28.4	3.33	3.50
19. Hist.	4f	8	7	38.8	31.8	3.65	3.64
20. Sociol.	1f	5	8	61.0	32.3	3.37	3.66
21. Sociol.	6f	4	4	49.3	37.0	3.74	3.39
22. Econ.	1f	17	16	30.8	23.3	3.36	3.24
23. Econ.	1f	2	8	43.5	26.0	2.90	3.18
24. Econ.	25f	10	10	36.3	22.2	3.50	3.76
25. Psy.	1f	19	20	34.5	30.2	3.38	3.39
26. Psy.	4f	5	5	48.2	38.4	3.49	3.39
Averages				38.94	26.57	3.77	3.84

The above description is merely an explanation and is not intended as a justification of the weights assigned. Only a rough index was desired, and it was felt that these arbitrary values were sufficiently well suited to the purpose.

The index was calculated for the combined distribution of marks in all sections for the fall quarter having the largest average enrollment per section and for the fall quarter having the smallest average enrollment per section in the same courses, whose average annual sizes have been given in previous tables. A comparison of the indices is given in the last two columns of Table XXVI. The smaller the index the greater is the relative proportion of high marks.

Fifteen of the 26 comparisons are in favor of the largest average section and 11 are in favor of the smallest. Although the difference in the average index for all courses is in favor of the large sections, the advantage is very slight. For individual courses the index is in favor of the largest average groups in 57.7 per cent of the cases and in favor of the smallest average groups in 42.3 per cent of the cases.

To provide a better means of interpreting these differences, Table XXVII was devised. It shows, for certain of the courses listed in Table XXVI, the median index and the variability of the indices over the seven-year period and should be read as follows:

English Af has a median index of 3.73, with a quartile range of .27, a low index of 3.17, and a high index of 4.62. Half of the indices extend from 3.51 to 4.04, or a total range of .53 units.

This information may in turn be applied to Table XXVI. There the index of the group of largest average sections was 4.62 and the index of the group of smallest average sections was 3.49. The difference between these indices is 1.13, which is more than twice the range of the middle 50 per cent of all courses. In a similar way the other differences may be interpreted. Table XXVIII is supplied as an aid in interpreting Table XXIX.

The discussion thus far has dealt entirely with large and small classes, no mention having been made of medium-sized classes. The four basic courses in the College of Education, which have been liberally drawn upon throughout the study by reason of our considerable confidence in the objective measurement of results,

TABLE XXVII

Central Tendencies and Variability of Mark Indices of Representative Undergraduate Courses (All Sections Combined) at the University of Minnesota, Fall Quarters, 1920-26, Inclusive

Course and Dept. No.	No. of Courses	Range of Mark Indices					
		Q	Low	Q_1	Md.	Q_3	High
English Af	7	.27	3.17	3.51	3.73	4.04	4.62
Eng. Survey 1f	7	.15	3.62	3.74	3.79	4.04	4.15
Eng. 4, 6 & 8f	21	.45	3.03	3.21	3.63	4.06	4.48
German 1 & 4f	14	.06	3.10	3.77	3.87	3.98	4.18
French 1, 3 & 4f	21	.55	2.61	3.37	3.93	4.46	4.62
Hist. 1 & 4f	14	.08	3.33	3.54	3.64	3.69	4.54
Sociol. 1 & 6f	14	.09	3.09	3.33	3.39	3.51	3.74
Math.	25	.27	3.69	4.01	4.30	4.54	4.95
Engineering Math.	14	.44	3.52	4.16	4.32	5.04	5.18
Economics 1f	14	.25	2.90	3.25	3.50	3.75	3.95
Psychology 1f	7	.08	3.38	3.44	3.52	3.60	3.77
Psychology 4f	7	.08	3.04	3.44	3.54	3.59	3.78
Average		.23	3.21	3.56	3.76	4.03	4.33

TABLE XXVIII

Central Tendencies and Variability of Mark Indices of the Four Basic Undergraduate Courses in the College of Education Taught by the Same Instructors over a Period of Years

Instructor	Course No.	Range of Mark Indices					
		Q	Low	Q_1	Md.	Q_3	High
Alexander	Ed. 1	16	2.73	2.98	3.12	3.29	3.76
Finney	Ed. 3	12	2.04	2.87	3.00	3.11	3.47
Hudelson	Ed.15	8	2.73	2.98	3.12	3.29	3.76
Miller	Ed.55	17	3.00	3.05	3.14	3.22	3.50

are again presented in Table XXIX as evidence on this point. In each of these courses all classes that might unequivocally be called large were isolated and the mark index determined for the combined distribution of marks. The same was done for all obviously small classes; likewise for the remaining sections, which were termed medium. As may be seen from the last column in Table XXIX, in spite of the enormous differences in size, no marked advantage can be discovered for any size. This uncon-

trolled material tends to show that the medium-sized class is probably neither more nor less effective than the large or the small class.

TABLE XXIX

Comparison of Mark Indices in Largest, Medium-Sized, and Smallest Sections in Required Undergraduate Courses in Education, Taught by the Same Instructors, 1920-26

Course and Instructor	Type of Section	No. of Sections	Average Size	Average Index of Marks
	Largest	2	251.0	3.40
I. Educational Psychology (55)	Medium	12	115.9	3.22
(Miller)	Smallest	4	52.7	3.39
	Largest	6	113.8	3.19
II. Techniques of H.S. Instr. (15)	Medium	3	73.7	3.19
(Hudelson)	Smallest	5	25.8	3.17
	Largest	7	103.9	3.15
III. History of Education (1)	Medium	15	62.3	3.29
(Alexander)	Smallest	9	27.4	3.11
	Largest	9	117.0	3.09
IV. Educational Sociology (3)	Medium	10	77.8	3.04
(Finney)	Smallest	6	45.8	3.00

It may be objected that final marks are poor criteria of the efficiency of instruction. Possibly so; nevertheless, as far as the student is concerned, they represent the most potent and far-reaching bits of tangible evidence of the success of his stay in the University. Probably the largest single phase of university administration is concerned with the manipulation of marks. They determine in large measure a student's success in class work, participation in extra-curricular activities, graduation, honors, recommendations, and employment. Marks are poor, then, only to the extent that they misrepresent achievement. This is a problem of validity of measurement and is of no concern here, since it may safely be assumed that in a study like this where large numbers are involved, the conditioning factors operate quite as much on the small groups as on the large.

It may further be objected that since marks are often distributed according to the Caussian curve of distribution, there is

no reason to expect a differentiation between large and small classes. In reply it may be stated that in most of the courses under discussion uniform major examinations are usually given to the entire student membership of the course as a group and not in isolated classrooms. Furthermore, the class identity of the individual is usually lost in the common grading, and the normal curve, where employed, usually applies to the entire class rather than to a single section.

A more valid objection is that in massed data such as have been presented, there is a strong possibility that the same instructors are not represented in both the large and the small sections. To a limited extent this is true; but on the whole the teaching personnel in the courses studied is fairly constant. We must again fall back upon the offsetting effect of large numbers over a period of years. Furthermore, it has been determined[3] that although colleges and departments vary widely from each other, the distribution of marks within any one department is fairly consistent. Finally, in that portion of the present study where instructor, course, and quarter were all held constant, corroborating evidence was adduced.

It is admitted that all of the objections may to some extent apply; nevertheless the evidence is considered worthy of serious consideration, first, because the diverse elements all point toward a uniform conclusion and, second, because this conclusion is so consistently supported by the carefully controlled experimental evidence to be presented later.

Summary

During the period 1920 to 1925 increased enrollment at the University of Minnesota has caused a decided increase in the number of classes taught in the fall quarter. This increase was 42 per cent in the College of Education, 35 per cent in the College of Engineering, 24 per cent in the College of Liberal Arts, and 7 per cent in the School of Business. In the same period there has been a decided increase in the average size of classes in the College of Education and in the College of Pharmacy. Classes have increased significantly in the Arts College, have remained

[3] John E. Bohan, "Students' Marks in University Courses" (Unpublished Ph.D. thesis, University of Minnesota, June, 1926), p. 104.

practically unchanged in the College of Engineering, and have decreased in the School of Business Administration and in the School of Mines.

There is wide variation among departments in the average annual size of classes in the more populous sectioned courses. There is even considerable variation in the average size of classes in a given course in the same department from year to year.

While policies differ as between colleges, as between departments within colleges, and even as between courses within departments, the usual response to increased enrollment is to increase the number of sections scheduled. A wide range is frequently found even in courses in which sectioning is operative.

In five populous freshman courses over a period of years there is no apparent relationship between the size of the sections and student marks. The distribution of A's, B's, C's, etc., is practically identical in the largest and smallest classes within each course. The net advantage is slightly in favor of the large sections. There is a slight tendency for marks in the smaller classes to distribute themselves more widely than in the large classes. The more exclusively marks are based upon objective evidence, the more nearly their distributions are identical in large and small classes.

Sectioning on the basis of ability does not seem to bring any decided advantage in the distribution of marks to either the large or the small sections of representative freshman courses.

Holding instructor, course, and quarter constant, and varying only the size of the class does not seem to disturb the similarity of mark distributions.

When the marks in several populous courses were converted into weighted numerical indices, the mean difference in favor of the larger classes was more than twice the range of the middle 50 per cent of all of the courses.

On the basis of assigned marks, medium-sized classes appear to be neither more nor less effective than small or large classes in the courses examined.

CHAPTER V

STUDENT TESTIMONY

Since the problem of class size is thought to be intimately related to the welfare of students, it was deemed worth while to secure their reactions to debatable aspects of the problem. While mere opinion, however well grounded on experience or guided by disinterested judgment, is by no means equal in validity to sound experimental evidence, nevertheless consensus of opinion helps to clarify the issue by bringing critical points into relief, thus enabling experimenters to meet the issues squarely. Several measures were therefore taken of student opinion on class size.

First Inquiry

During 1924 the students in four large classes in the College of Education were asked to indicate in writing their reactions to the following question:

In the light of all of your college and university experience here or elsewhere, do you prefer large or small classes? Call an enrollment of thirty or less a small class; more than thirty a large class.

They might endorse their responses or not, as they chose. Table XXX shows the results of the inquiry. The students in two of the classes were invited to qualify their reactions if they so desired by stating the reasons for their preferences. Their comments were classified and are quoted here with their frequencies:

Large classes better for lecture courses; otherwise small classes better, 21. Immaterial in lecture courses; in all other cases small class preferred, 10. For undergraduate courses, small classes; for graduate courses, large preferred, 3. Much depends upon the instructor, but on the whole small classes are better, 3. Depends upon subject and upon whether graduate or undergraduate. Undergraduate small; graduate large, 2. Depends upon subject matter and method of presentation, 2. Depends upon method of conducting class. On the whole small classes have been better, 2. One can be made as profitable as the other, 2. Best arrangement is to divide large classes into small quiz sections on certain days, 2. Large classes make one more independent and force one to accept more responsibility; but all the same I prefer small classes, 2. I prefer large classes for lecture and graduate courses, 1. Small classes preferred for all except graduate lecture courses, 1. Large for lecture and adult courses; small for

discussion groups, 1. Restrict admission on basis of tests, 1. Large in general, especially for graduate work; small for research, 1. Small for mathematics and science; for others, large—especially in general discussion groups, 1. Size of class doesn't matter; it's the teacher that counts. Generally a good teacher has large classes. Sometimes a poor one has if he gives high grades and little work. Such work as statistics is better handled in small groups, 1. Immaterial; it's the organization, technique, and teacher that count, 1. Small classes preferred as a rule. Where discussion looms large I prefer large classes, since they offer more viewpoints and enrich the content, 1. I prefer small classes (20-30) for recitation, but the large class is better for lecture courses in that it is more economical, 1. They both have their place in a university, 1. Most of the classes in this University are far too large, 1. There are so few able professors that classes must be large to give each student an opportunity to come in contact with experts, 1. It all depends upon the purpose of the course. Detailed mastery necessitates small classes; general knowledge can be gained as well in large classes, 1. I prefer small classes in spite of the fact that my most interesting instructors have been in large classes, 1. Small classes are preferable, but large classes can be made better than they are, 1. If the method used is an effective one, the large class is better and more effective for the University. This is not true in high school, however, where the lecture method is inadvisable, 1.

The reason most frequently given by those who unqualifiedly preferred large classes was the increased opportunity for contact, student with student and student with instructor. The most frequent objection to large classes was that they are embarrassing owing to the necessity of having to shout to make oneself heard.

TABLE XXX

Student Response to Teacher-Instigated Inquiry on Class Size

Course	Year and Quarter	When Asked	No. of Cases	Per Cent Favoring Small Classes	Per Cent Favoring Large Classes	Per Cent of Qualified Responses
Ed. 55. Educational Psychology	1924su	Next to last day	92	65.0	35.0	No opportunity
Ed. 113. High School Curriculum	1924su	Second day	51	41.8	11.7	46.5
Ed. 15. Techniques of High School Instruction	1924s	Second day	83	49.0	0.0	51.0
Ed. 15. Same	1924f	Tenth week	84	94.0	6.0	No opportunity

Second Inquiry

Lest these students may have felt somewhat restrained about recording even anonymous opinions to a faculty-instigated inquiry, it was considered advisable to have their attitudes on class size canvassed by one of their own members. Accordingly, in March, 1927, Miss Agnes Thorvilson, then a senior, was requested to secure the testimony of as large and representative a sampling of students as time would permit. A summary of the report that she later gave before the seminar on Problems of College Education follows:

Anonymous written responses were gathered from 122 freshmen, juniors, and seniors on their attitudes toward large and small classes, with their reasons therefor. Two students preferred large classes, 4 expressed indifference, and 116 favored small classes. Their classified reactions, with percentage frequencies, were as follows:

I. Reasons for preferring large classes:
   More varied opinions and views are expressed in the discussion type of large class, 4.1 per cent.
   Grades in large classes not based upon prejudice, 2.5 per cent.
   Instructors prepare better for large classes, 1.6 per cent.

II. Reasons for neutral attitude toward class size:
   It all depends upon the instructor; a good teacher can do as well with a large class as he can with a small one, 3.2 per cent.

III. Reasons for preferring small classes:
   Closer personal contact with instructor, 55.5 per cent.
   Less chance to bluff, 51.3 per cent.
   More personal attention (conferences, etc.), 50.0 per cent.
   Stimulate interest and independent thinking, 50.0 per cent.
   More conducive to informal discussion, 48.8 per cent.
   Grades assigned more fairly, 30.1 per cent.
   Students come to know each other better, 25.5 per cent.
   Meek students have a fairer chance, 25.5 per cent.
   Prevent a standardized, mechanical education, 24.1 per cent.
   Create in the student a sense of personal responsibility toward his education, 23.0 per cent.

It is not feasible in the space available to try to convey these students' reactions in sufficient detail to enable them to be compared to those secured in the first inquiry. It must suffice to report that both groups indulged in considerable rationalizing on principles of classroom teaching that are by no means established and that the members of the second group were less analytical in their

reasoning but more fervid. In her report Miss Thorvilson quoted the following response as being representative of the majority of the group, though admittedly more "Menckenesque" in style:

> Education by the yard! History at so much, philosophy at so much! Wholesale education by the herd method wherein students are numbers and individuality is only a pink felt hat or a gray suit. This is modern education à la Minnesota where the herd method is faithfully followed. There is no real mutual interchange of ideas between the intelligent student and the professor; no chance for any further gain in the way of culture through association and contact with those above them. The professor is a "stranger-lecturer" to his students. They sit in herds and listen in herds to ideas and data composed by the lecturer for herds. Sheep education, wherein Scandinavian lambs methodically assimilate required data, take hygiene, and trot from the scholastic pasture with a diploma [sheepskin?]—uncontaminated by personality, individual thought, or personal help from the instructor of herds.
>
> Give us smaller classes, wherein the wistful lamb can get more from the educational farce for which he pays each quarter. Help us to find our personalities! Help us to think more than pattern thoughts! Give us more than the pot-boiling data that a paid professor grinds out to a sea of young faces! Spare us from machine-made lives!

Though not the author of the above denunciation, one student in an equally vehement invective raised an issue that must loom large to all instructors who take seriously their responsibility of recommending their students for employment. This young woman was a senior and in need of a position, and she was experiencing difficulty in securing influential letters of recommendation. Though it happened in this case to be not the real reason, she attributed her situation to the fact that several of her classes had been large and that few of her instructors knew anything more about her than their classbooks told them.

Either expressed or implied, there runs through practically every response to the second inquiry the sentiment, quoted from one of the papers, "I like to be an entity to my instructors. If they realized how anxious their students are to know them, they would exert every effort to make such acquaintance possible."

Third Inquiry

It will be recalled that the aim of the above inquiries was to elicit from students such opinions on class size as would, by bringing the major issues into relief, guide the subcommittee in devising

experimental techniques for attacking directly those major issues. The aim was not realized. The responses to such general inquiries were too sporadic and speculative to provide the necessary objectivity upon which to build experimental techniques. It was therefore decided to solicit from the student body the exact testimony needed. Accordingly, a three-page questionnaire, a copy of which may be found in the Appendix, was prepared and distributed to approximately a thousand representative students. An attempt was made to have somewhat equal representation from freshmen, sophomores, juniors, seniors, and graduates. Lest the factor of immediate propinquity might influence the responses, the questionnaire was submitted to twenty-one small classes and to ten large ones,

The student response was excellent, but it was found that representation was decidedly heaviest from the freshman and junior students; so, since the cleavage was to be made on the basis of lower- and upper-classmen and since only a representative sampling was desired, the tabulations were limited to 65 freshmen and 35 sophomores and their opinions accepted as the expression of junior-college students. The reactions of 50 juniors, 34 seniors, and 16 graduates were considered representative of upper-classmen opinions. In order that the sampling might be as random as possible, the first replies submitted by each group which met the twofold criteria of experience with both large and small classes and a fair degree of completeness of reply, were accepted for tabulation. The students were about equally divided as to sex and ranged in age from less than nineteen to more than forty. Thirty-seven major fields of study were represented in the returns.

Experience with Large and Small Classes

As previously stated, only those students who had had definite college experience with both large and small classes were included in the tabulations. The amount of such experience is given in Table XXXI. It will be seen that the median small-class experience for the junior-college students was slightly over 4, or about half that for senior-college students. The lower-classmen had had a median experience of 4.3 large classes, whereas the median for senior-college and graduate students was somewhat more than 11, the exact amount being unascertainable.

TABLE XXXI

NUMBER OF SMALL AND LARGE COLLEGE CLASSES ATTENDED BY STUDENTS WHOSE REPLIES ARE TABULATED

Classes Attended	Students Replying					
	Senior College and Graduate		Junior College		All	
	S	L	S	L	S	L
1-5	28	22	75	71	103	93
6-10	45	24	17	22	62	46
11 or more	27	54	8	7	35	61
Total	100	100	100	100	200	200
Median	8.4	11+	4.3	4.5	5.9	6.8

To safeguard still further against the tendency toward rationalization in replies of this nature, the following letter was given to each instructor who cooperated in placing blanks in the hands of his students:

To the Instructor:

The inquiries concerning student experience with large and small classes should be filled out by your students in the classroom. It is hoped that twenty minutes will suffice for the purpose, but if the instructor thinks it necessary, more time may be allotted. The object is to secure representative student reactions.

After distributing the blanks, kindly read the following instructions to your students:

In the three-page inquiry which has been handed to you answer as many of the questions as you feel competent to answer. Make your replies as clear and as concise as possible. Avoid rationalizations; i.e., be careful to base all of your answers upon *your actual experience* with large and small classes *in college or university.* You will have twenty minutes, so please work rapidly. When you have completed your replies, fold the blanks and place them in the large envelope provided.

We wish to express our appreciation of your cooperation.

Sincerely yours,

Subcommittee on Class Size

A self-addressed envelope was supplied with each blank, and provision was made through the campus mailing system for direct transmission of replies to the subcommittee office, so that the element of instructional restraint need have no influence.

Opinions as to Limits in Class Size

The terms *large* and *small,* having no absolute meaning, must always be interpreted relatively. It was therefore necessary to provide some common basis for interpreting the replies. This was further complicated by the fact that no arbitrary limits could be established, since they must vary according to collegiate division, type of course, and subject matter. Because the inquiry was designed to survey diverse fields, it was believed most feasible to have each person who replied state definitely just what his concept of a large and a small class was. It was stipulated in the questionnaire that his opinion on this matter would be taken as a basis for interpreting all of his subsequent reactions.

Incidentally, the composite replies provide a fair picture of student opinion concerning desirable limits for small and large classes of each type and the ideal size. These facts are displayed in Table XXXII. Although the numbers of cases are too small to have much significance, it is interesting to note that in only three instances is the optimum size below the upper limit established for the small class, while, in spite of the conservative nature of the

TABLE XXXII

Median Student Opinion Concerning Class Size
(All students replying.)

Collegiate Division	Predominant Type of Class	Number of Students to Be Considered as the: Upper Limit of Small Class	Lower Limit of Large Class	Optimum (Ideal) Size of Class
1. Junior college	Lecture	50 (149)	100 (149)	105 (148)
	Recitation	25 (170)	35 (157)	25 (170)
	Laboratory	30 (111)	40 (110)	30 (111)
2. Senior college	Lecture	50 (93)	75 (87)	75 (86)
	Recitation	25 (98)	30 (99)	20 (94)
	Laboratory	25 (64)	30 (64)	20 (63)
3. Graduate	Lecture	35 (40)	40 (39)	50 (41)
	Recitation	15 (47)	25 (46)	15 (49)
	Laboratory	15 (33)	20 (33)	15 (37)

Numbers in parentheses indicate number of judgments included.

replies, in three cases also the ideal size is at or above the lower limit of the large class. If this tendency were to maintain with a significant number of students in any one department it would be meaningful. It is pertinent to state in this connection that, in gen-

eral, upper-classmen appeared to be much more conservative in their limits than did lower-classmen.

TABLE XXXIII

Size of Class Students Prefer to Attend

Class	Students Replying: Senior College and Graduate — No. and per cent	Junior College — No. and per cent	All — No.	All — Per cent
Large	17	7	24	12.0
Medium	39	31	70	35.0
Small	33	60	93	46.5
Immaterial	11	2	13	6.5
Total	100	100	200	100.0

TABLE XXXIV

Size of Class Yielding the Most Satisfactory Mark to the Student

Class	Students Replying: Senior College and Graduate — No. and per cent	Junior College — No. and per cent	All — No.	All — Per cent
Large	21	11	32	16.0
Medium	30	27	57	28.5
Small	28	57	85	42.5
Immaterial	21	5	26	13.0
Total	100	100	200	100.0

TABLE XXXV

Size of Class Yielding the Least Satisfactory Mark to the Student

Class	Students Replying: Senior College and Graduate — No. and per cent	Junior College — No. and per cent	All — No.	All — Per cent
Large	48	73	121	60.5
Medium	6	3	9	4.5
Small	28	18	46	23.0
Immaterial	14	6	20	10.0
No reply	4	0	4	2.0
Total	100	100	200	100.0

Table XXXIII records the size of class that students prefer to attend. It will be seen that 60 per cent of the lower-classmen favor small classes while only 7 per cent prefer the large. The upper-classmen are more catholic in their choice, 11 per cent putting other factors before that of class size. Graduate students prefer the medium-sized class, seniors the small, juniors the medium, sophomores are undecided between the medium and the small, while freshmen overwhelmingly prefer the small. Since there are exactly 100 cases in each group, the frequencies may be read directly as per cents.

Effect of Class Size on Student Marks

Though possibly not the most important, certainly the most lasting record that a student receives from a course is the mark that is permanently entered upon the registrar's files. Table XXXIV indicates the students' opinions regarding the size of the class that yields them the most satisfying mark. The total distribution of lower-classmen follows closely that given in the previous table, although there is considerable shifting among both freshmen and sophomores. The upper-classmen, particularly the graduates, are almost neutral.

More than 60 per cent of all classes combined claimed that large classes yield least satisfactory marks (Table XXXV). In view of the data on this point presented in Chapter IV, which refute entirely this impression, it is difficult to account for such a consensus of opinion; yet it is in accord with that reported by Edmonson and Mulder in a similar study at the University of Michigan.[1]

Effect on Students—Types Favored

To shed further light on this question, the students were asked what type of student is particularly favored by large classes. The replies, recorded in Table XXXVI, indicate that the better type, including the superior, aggressive, and reflective, are at an advantage. It is interesting to note, however, the diversity of opinion on this point, almost every type of student being included in the reply.

Responses to the counter-question are presented in Table XXXVII. This indicates students' opinions as to the type favored

[1] J. B. Edmonson and F. J. Mulder, "Size of Class as a Factor in University Instruction," *Journal of Educational Research*, 9:1-12 (January, 1924).

TABLE XXXVI

Student Opinion as to Type of Student Favored by the Large Class

Type of Student Favored	Students Replying			
	Senior College and Graduate	Junior College	All	
	No. and per cent	No. and per cent	No.	Per cent
Superior	24	33	57	28.5
Aggressive	36	12	48	24.0
Reflective	4	1	5	2.5
Average	8	10	18	9.0
Timid	3	6	9	4.5
Grind	1	8	9	4.5
Crammer	3	6	9	4.5
Lazy	13	11	24	12.0
Inferior	2	8	10	5.0
Cheat	1	4	5	2.5
Immaterial	4	1	5	2.5
No reply	1		1	.5
Total	100	100	200	100.0

TABLE XXXVII

Type of Student Favored by Small Classes

Type of Student Favored	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
Superior	8	7.41	26	22.61	34	15.25
Aggressive	11	10.19	6	5.22	17	7.62
Serious	14	12.96	15	13.04	29	13.00
Facile in discussion	9	8.33	9	7.83	18	8.07
Average	10	9.26	12	10.43	22	9.87
Timid	29	26.85	13	11.30	42	18.84
Grind			4	3.48	4	1.79
Lazy	9	8.33			9	4.04
Inferior	12	11.11	24	20.87	36	16.14
Bluff	1	.93	1	.87	2	.90
Immaterial	5	4.63	5	4.35	10	4.48
Total	108	100.00	115	100.00	223	100.00

by the small class. There is a diversity of opinion here likewise, all of the categories of Table XXXVII being again represented. The most significant departures are found in the case of the timid and inferior students, both, it was claimed, being decidedly advantaged by the small class. On the other hand, the lazy student was thought to be favored by the large class. About 44 per cent felt that the small class works to the advantage of the above-average student, while 55 per cent thought that he is favored by the large class. The two groups of replies are, on the whole, in considerable agreement.

TABLE XXXVIII

Number of Times Individual Instructors Were Cited as Best Large-Class Instructors

No. of times mentioned	1	2	3	4	5	7	8	13	15	26
Individual instructors	54	7	4	5	3	1	2	1	1	1

TABLE XXXIX

Departmental Location of Instructors Mentioned at Least Twice as Best Large-Class Instructors

Department Represented	Number of Times Mentioned								
	2	3	4	5	7	8	13	15	26
Animal Biology			1			1	1		
Bacteriology	1								
Botany			1						
Economics		1							
Ed. Administration		1							
Ed. Psychology									1
Ed. Sociology				1					
English	1		1						
French	1								
Geology				1					
History	2				1			1	
Hygiene		1							
Mathematics			1						
Org. Chemistry	2	1							
Physics					1				
Political Science			1						

Large-Class Instruction

In the belief that recital of student experience with large-class instruction might prove to be valuable, the students were asked to characterize the type of instructor whom they considered best qualified to conduct large classes. In order to make the responses

TABLE XI

Student Opinions on Qualities of Instructor Best Fitted to Handle Large Classes

Items	Frequency of Mention	
	No.	Per Cent
I. Skill in Instruction	(323)	(45.49)
a. Good lecturer	101	14.22
b. Interesting	69	9.71
c. Handles discussions well	67	9.43
1. Secures student participation	17	
2. Keeps to point	12	
3. Skilled in questioning	12	
4. Good disciplinarian	9	
5. Summarizes points	7	
6. Avoids too many details	6	
7. Fertile in suggestions	4	
d. Makes clear explanations	20	2.81
e. Good at illustrating	13	1.83
f. Skilled in assignments	8	1.12
1. Uses outlines	5	
2. Makes definite assignments	2	
3. Considers time needed for preparation	1	
g. Secures student viewpoints	7	.98
h. Plans daily work carefully	7	.98
i. Adjusts subject to ability of students	6	.84
j. Assists in formation of study habits	6	.84
1. Insists on preparation of all assignments	4	
2. Gives study directions	2	
k. Skilled in measuring results	6	.84
1. Uses frequent tests	3	
2. Uses objective tests	2	
3. Tests ability to understand	1	
l. Dictational	6	.84
m. Stimulates intellectual curiosity	3	.42
n. Reviews frequently	3	.42
o. Has knowledge of teaching principles	1	.14

TABLE XL—*Continued*

STUDENT OPINIONS ON QUALITIES OF INSTRUCTOR BEST FITTED TO HANDLE LARGE CLASSES

ITEMS	FREQUENCY OF MENTION	
	No.	Per Cent
II. Personal Qualifications	(230)	(32.40)
a. Good personality	55	7.74
b. Sense of humor (proportion)	41	5.77
c. Good voice	40	5.63
d. Interest in subject matter (inspiring)	32	4.50
e. Sympathetic attitude toward students	22	3.09
f. Tactful with students (not rude)	17	2.39
g. Open-minded (fair, just)	11	1.54
h. Interested in teaching	7	.98
i. Free from idiosyncrasies	3	.42
j. Accessible to students (conferences)	1	.14
k. Self-reliant (confidence, poise)	1	.14
III. Knowledge and Organization of Subject Matter	(153)	(21.55)
a. Possesses broad, accurate knowledge of subject	72	10.14
b. Organizes course well	20	2.81
c. Specific	16	2.25
d. Selects material effectively	15	2.11
e. Provides good balance in emphasis	12	1.68
f. Relates subject matter to current affairs	11	1.54
g. Relates subject matter to other subjects	7	.98
IV. Professional Development	(4)	(.56)
a. Keeps up to date in his subject	3	.42
b. Has prestige in his field	1	.14

as concrete as possible, an attempt was made to have them associated with definite personalities. Each student was requested to name whom he remembered as his best large-class instructor.

The responses are listed in Table XXXVIII and XXXIX. As was to be expected, since the sampling of students was so widely and thinly scattered throughout the University and since all class levels are represented, the replies show great diversity. Out of 192 judgments, 79 different instructors were named. Of these, 54 were mentioned only once, while, at the other extreme, one instructor was selected 26 times, another 15 times, and another 13 times. In spite of the extreme range of replies, it is encouraging to note

that there appears to be some clear recognition of who most adequately meets the students' conception of a good large-class instructor. Another gratifying feature is the wide distribution among departments, sixteen being represented by those teachers who received two or more votes, while the entire list of 79 instructors was drawn from 25 separate departments. This seems to indicate that good large-class teaching is possible in diverse fields. It will be noted also that the humanities and laboratory subjects are interchangeably included. It would seem that with the possible proviso that in some cases special adaptations of technique may have to be devised, large-class instruction has wide application.

Qualities of Best Large-Class Instructors

Listing of instructors was only incidental to the chief end sought, namely, determination of those qualities which caused the students to list a given person as a good large-class instructor. These desirable attributes are listed in Table XL under the four major heads of skill in instruction, personal qualifications, knowledge and organization of subject matter, and professional development. Although there may be some slight overlapping in these rubrics, the distinctions are in the main fairly clear-cut. There is also present the ever-constant danger of misinterpreting the students' comments. To avoid this danger, which is greatly increased by the tendency, in the interest of ease of tabulation, to confine all items to the Procrustean bed of previously prepared classifications—in the case of all doubtful items, additional divisions were made.

Out of a total of 710 frequencies, skill in instruction, with 323 mentions distributed among fourteen subclassifications, ranked first, 46 per cent of the students listing items under this head. Personal qualifications stood second, eleven subdivisions being mentioned an aggregate total of 230 times, or 32.4 per cent of all replies. Third place went to knowledge and organization of subject matter, 153 listings, or 21.55 per cent of the responses being scattered over seven subclassifications. Professional development received only four votes. To the extent that these reactions are representative, it may be concluded that, according to student opinion, the chief factors in the success of large-class instruction are skill in teaching and adequate personal qualifications, in the order

named. Later in this chapter, under the topic "Administrative and Instructional Aids," light from another angle will show that these students are consistent in their opinions.

It may be profitable to examine the more frequent reactions in detail. Table XLI presents separately the qualities that were listed twenty or more times. Here we have the composite judgment of 200 students as to the most desirable attributes of successful large-class instructors. With but two exceptions all of them fall under skill in instruction or personal qualifications. Of the 710 reactions, these eleven subdivisions include 539, or 75.9 per cent. In view of the fact that lectures are so commonly employed with large classes, it is not surprising to find "ability to lecture well" heading the list. It was to be expected "ability to handle discussion well" would rank high, since one of the chief objections that students have to large classes is their lack of opportunity for class discussion. On the other hand, since this item is not mentioned even more frequently and since the replies are based upon actual experience, it may be inferred that discussion is already being used with considerable success in large classes.

TABLE XLI

Leading Qualities of Instructor Best Fitted to Handle Large Classes

Item	Mention	
	No.	Per Cent
1. Good lecturer	101	14.22
2. Possesses broad, accurate knowledge of subject matter	72	10.14
3. Interesting	69	9.71
4. Handles discussion well	67	9.43
5. Good personality	55	7.74
6. Sense of humor (proportion)	41	5.77
7. Good voice	40	5.63
8. Interest in subject matter	32	4.50
9. Sympathetic attitude toward students	22	3.09
10. Makes clear explanations	20	2.81
11. Organizes course well	20	2.81
Total	539	75.9

TABLE XLII

Type of Instruction Best Adapted to Large Classes

Type	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
Lecture	50	56.3	34	50.0	84	53.6
Lecture with discussion or quizzing	23	25.8	19	28.0	42	26.8
Lecture with quiz sections	4	4.5	2	2.9	6	3.8
Lecture demonstrations	3	3.4	3	4.4	6	3.8
Lecture and laboratory	1	1.1	4	5.9	5	3.2
Outside readings	3	3.4	3	4.4	6	3.8
Textbook assignments	2	2.2	3	4.4	5	3.2
Socialized procedure	1	1.1			1	.6
Individual work	1	1.1			1	.6
Term papers	1	1.1			1	.6
Total	89	100.0	68	100.0	157	100.0

With the possible exception of item 1, it would seem that the items listed in Table XLI are in no way different in kind from the qualities which all successful teachers must possess. It is not unlikely that the best training for large-class instruction is successful experience with smaller classes.

Best Large-Class Teaching Methods

The students were asked to list the types of instruction best adapted to large classes. Table XLII shows that over half of the students believe that pure lecture is the best method. Lectures interspersed with discussion and quizzes rank second. The two together represent 80 per cent of the student opinions. About 4 per cent accept the lectures for large groups but want these broken up occasionally—weekly, as a rule—for discussions or quizzes. Only two students perceive the possibilities of individual work and socialized procedures in large classes.

Student-Teacher Contacts and Student Participation

One of the strongest objections to large classes, from students and faculty alike, is the lack of personal contact between student

and teacher. Questions 14 and 19 were put with a view to throwing light on this problem. The questions were as follows:

Approximately how many personal consultations (office visits for help with course work, not merely to inquire about marks) do you have on the average per quarter with each large-class instructor?

How many of these have been initiated by you (not due to request from instructor)?

How many personal consultations per quarter with each small-class instructor? How many of these were initiated by you?

Do you feel that the student in the large class is handicapped by lack of personal contact with the instructor? If so, what would you suggest to overcome the handicap?

TABLE XLIII

NUMBER OF PERSONAL CONSULTATIONS (OFFICE VISITS FOR HELP WITH COURSE WORK—NOT MERELY TO INQUIRE ABOUT MARKS) THAT STUDENTS HAVE ON THE AVERAGE PER QUARTER WITH EACH LARGE-CLASS INSTRUCTOR

Number of Conferences	Students Replying			
	Senior College and Graduate	Junior College	All	
	No. and per cent	No. and per cent	No.	Per cent
0	62	49	111	55.5
1	21	29	50	25.0
2	9	6	15	7.5
3	6	6	12	6.0
4	1	6	7	3.5
5	1	2	3	1.5
6		0	0	
7		0	0	
8		0	0	
9		0	0	
10		1	1	.5
11		1	1	.5
Total	100	100	200	100.0
Median	0	1	0	

The replies to the first question are found in Table XLIII. The average number of conferences with each large-class instructor ranges from none to eleven, with a median of none. Over half of these students, in other words, report that no conferences are held. Many of the students stated that they might have had conferences if

they had wanted them—they just did not go. Others reported that they were able to see their instructors as often as they, the students, wished. The upper-classmen express less need for conferences than do the lower-classmen.

TABLE XLIV

AVERAGE NUMBER OF PERSONAL CONSULTATIONS, CONCERNED WITH DEFINITE HELP ON COURSE WORK, INITIATED PER QUARTER BY THE STUDENT WITH EACH LARGE-CLASS INSTRUCTOR

Number of Conferences	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
0	5	13.16	7	13.73	12	13.48
1	17	44.74	22	43.14	39	43.83
2	9	23.68	10	19.61	19	21.35
3	5	13.16	4	7.84	9	10.11
4	1	2.63	4	7.84	5	5.62
5	1	2.63	2	3.92	3	3.37
6			0		0	
7			0		0	
8			0		0	
9			0		0	
10			1	1.96	1	1.12
11			1	1.96	1	1.12
Total	38	100.00	51	100.00	89	100.00
Median	2		1		1	

TABLE XLV

PER CENT OF PERSONAL CONSULTATIONS WITH LARGE-CLASS INSTRUCTORS, ACTUALLY INITIATED BY STUDENTS THEMSELVES

Per Cent of Conferences	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
1-24			2	4.76	2	2.74
25-49			2	4.76	2	2.74
50-74	1	3.23	2	4.76	3	4.11
75	1	3.23	2	4.76	3	4.11
100	29	93.54	34	80.96	63	86.30
Total	31	100.00	42	100.00	73	100.00

TABLE XLVI

Number of Personal Consultations Held by Students on the Average per Quarter with Each Small-Class Instructor

Number of Confer-ences	Students Replying			
	Senior College and Graduate	Junior College	All	
	No. and per cent	No. and per cent	No.	Per cent
0	30	15	45	22.5
1	22	25	47	23.5
2	12	23	35	17.5
3	12	16	28	14.0
4	8	7	15	7.5
5	8	5	13	6.5
6	4	2	6	3.0
7		1	1	.5
8		2	2	1.0
9				
10		3	3	1.5
11	4	1	5	2.5
Total	100	100	200	100.0
Median	1	2	2	

Who initiates the conferences that are held? Table XLIV supplies the answer, for this group at least. Of the 89 students actually holding conferences, over 86 per cent claim the initiative. This probably is as it should be. When a student feels the need of advice, it seems proper that he should seek the instructor with his problem. The instructor, on the other hand, should be sufficiently accessible and affable that the student will not lose patience and courage in his quest for an interview. There is considerable random evidence that students themselves, through lack of tact and a sense of the value of time, force their instructors out of self-defense to require the student to show cause why he desires a conference. Instructors are generally, if not always, available for economical, constructive interviews.

Table XLV shows for each student who responded the percentage of his conferences that were initiated by himself. Ninety-four per cent of the senior and graduate students initiate all of their conferences, none failing to initiate less than half. Only 81 per cent of the junior-college students initiate all interviews. Comparable

facts are set forth on consultations with small-class instructors in Tables XLVI and XLVII. It is apparent that students feel more free to consult with their instructors of small classes. The average number again ranges from zero to eleven, with the median at two. Students testify that while interviews are more readily secured with small-class instructors, they feel less keenly the need for such contacts because the class discussions give them adequate opportunity to air their difficulties and to unburden their souls. It appears likely that the difference lies not in the instructor but in the size of the class itself.

TABLE XLVII

AVERAGE NUMBER OF PERSONAL CONSULTATIONS PER QUARTER INITIATED BY STUDENT WITH EACH SMALL-CLASS INSTRUCTOR

Number of Conferences	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
0	3	4.29	16	18.82	19	12.26
1	24	34.28	24	28.24	48	30.97
2	18	25.71	19	22.36	37	23.87
3	10	14.29	12	14.12	22	14.19
4	3	4.29	4	4.71	7	4.52
5	5	7.14	2	2.35	7	4.52
6	4	5.71			4	2.58
7			2	2.35	2	1.29
8			2	2.35	2	1.29
9						
10			2	2.35	2	1.29
11	3	4.29	2	2.35	5	3.22
Total	70	100.00	85	100.00	155	100.00
Median	2		2		2	

Table XLVII shows a situation quite similar to that revealed in Table XLV; namely, that about 87 per cent of all conferences are initiated by students. It is significant, however, that the total number is considerably greater for small classes than for large. This is especially marked among upper-classmen. Conversely, a greater number of conferences with the small-class instructor are initiated by the instructor than is the case under large-class conditions.

Table XLVIII shows that whereas 86 per cent of the students initiated all conferences with their large-class teachers, the same is true for but 62 per cent of the small-class conferences.

TABLE XLVIII

PER CENT OF PERSONAL CONSULTATIONS WITH SMALL-CLASS INSTRUCTORS ACTUALLY INITIATED BY STUDENTS THEMSELVES

Per Cent of Confer-ences	Students Replying					
	Senior College and Graduate		Junior College		All	
	No.	Per cent	No.	Per cent	No.	Per cent
1-24	1	1.47			1	.75
25-49	2	2.94	1	1.54	3	2.25
50-74	11	16.18	20	30.78	31	23.31
75-99	10	14.71	5	7.68	15	11.28
100	44	64.70	39	60.00	83	62.41
Total	68	100.00	65	100.00	133	100.00

The students were then asked point-blank if they felt that students in large classes were handicapped by lack of opportunity for personal contact with the instructor. The replies listed in Table XLIX indicate that this contact may not be so all-important, even though a majority of the students express either an outright or a qualified affirmative. Eighty per cent of the lower-classmen are in agreement, but the upper-classmen are about equally divided on the question. Several again stated emphatically that they were able to secure all of the personal contacts with their instructors that they desired.

One hundred and twenty of the students who felt themselves handicapped availed themselves of the opportunity to offer suggestions on how to remedy conditions. As shown in Table L, 44 per cent could see no other solution than to teach smaller class units. One-fourth of the under-classmen and more than half of the upper-classmen felt that one solution lies in the opportunity for more conferences.

Students are continually clamoring for more and more participation and more and more discussion. In an attempt to evaluate this factor, they were asked if the value of a course to them was in direct proportion to the number of times they recited or partici-

pated in discussions. The replies in Table LI indicate that participation is of much less importance than is generally believed, nearly two-thirds of the students answering in the negative. This response was especially characteristic of the upper-classmen. A considerable number of the students wrote that they derived more benefit from listening to the discussions than from participating in them.

TABLE XLIX

STUDENT OPINION CONCERNING PRESENCE OF HANDICAP DUE TO LACK OF PERSONAL CONTACT WITH THE INSTRUCTOR IN A LARGE CLASS

Replies	Students Replying: Senior College and Graduate — No. and per cent	Students Replying: Junior College — No. and per cent	Students Replying: All — No.	Students Replying: All — Per cent
Yes, unqualified	32	65	97	48.5
Yes, qualified	17	15	32	16.0
No, unqualified	37	15	52	26.0
No, qualified	10	1	11	5.5
No reply	4	4	8	4.0
Total	100	100	200	100.0

TABLE L

STUDENT SUGGESTIONS AS TO OVERCOMING HANDICAP DUE TO LACK OF PERSONAL CONTACT WITH INSTRUCTOR OF LARGE CLASS

Suggestions	Students Replying: Senior College and Graduate — No.	Per cent	Junior College — No.	Per cent	All — No.	Per cent
Smaller groups	12	25.53	41	56.16	53	44.17
More conferences	25	53.19	20	27.40	45	37.50
Sympathetic attitude by instructor	4	8.51	3	4.11	7	5.83
More quizzes	1	2.13	5	6.85	6	5.00
Non-teaching advisers	1	2.13	3	4.11	4	3.33
Instructors of stronger personality	3	6.38	0		3	2.50
Give instructors more free time from research	1	2.13	1	1.37	2	1.67
Total	47	100.00	73	100.00	120	100.00

TABLE LI

Is Value of Course to the Student in Direct Proportion to the Number of Times He Recites or Participates in the Discussion?

Replies	Students Replying			
	Senior College and Graduate	Junior College	All	
	No. and per cent	No. and per cent	No.	Per cent
Yes, unqualified	18	30	48	24.0
Yes, qualified	7	13	20	10.0
No, unqualified	65	50	115	57.5
No, qualified	5	4	9	4.5
No reply	5	3	8	4.0
Total	100	100	200	100.0

The fact is inescapable that the under-classmen, particularly the freshmen, have a yearning for pupil-teacher associations that is not being satisfied. Possibly they might be accommodated better than they are. On the other hand, if they are expecting the intimate pupil-teacher relationships of their high school days, it is unavoidable that they will be disappointed. In view of the conditions that they will meet in later life, it might even be argued that a continuation of high school conditions would not be to their best interests. Where formerly they needed a mentor, now they should gradually assume their own responsibilities in preparation for the time a few years hence when all education will be self-education. That they can learn to lean upon themselves is evidenced by the lower frequencies of complaints among the upper-classmen.

TABLE LII

Relative Distribution of Disadvantages of Large Classes among the Major Divisions

Major Divisions	Distribution of Student Opinion			
	Senior College and Graduate		Junior College	
	No.	Per cent	No.	Per cent
1. Physical facilities	18	6.74	18	6.87
2. Effect on instruction	49	18.35	63	24.05
3. Measurement of results	104	38.95	105	40.08
4. Effect on students	96	35.96	76	29.00
Total	267	100.00	262	100.00

Disadvantages of Large Classes

In an attempt to uncover the objectionable features of large-class instruction, the students were asked to list all disadvantages of large groups. Five hundred and twenty-nine factors were men-

TABLE LIII

Disadvantages of Large Classes, Acccording to Students

Items	Frequency of Mention	
	No.	Per Cent
I. Physical Facilities	(36)	(6.80)
a. Difficulty of hearing	15	2.83
b. Difficulty of seeing	7	1.32
c. Lack of satisfactory physical facilities	6	1.13
d. Emphasizes mechanics of class management	6	1.13
e. Lack of adequate library facilities	2	.37
II. Effect on Instruction	(112)	(21.16)
a. Less class discussion possible	43	8.12
b. Increases distractions	14	2.64
c. Forces use of lecture method	13	2.45
d. Leads to less student attention	13	2.45
e. Tends to stereotyped instruction	10	1.89
f. Instructor's viewpoint is final (dogmatic)	7	1.32
g. Discipline more difficult	6	1.13
h. Unable to use conferences	4	.75
i. Instructor cannot stimulate thought	2	.37
III. Measurement of Results	(219)	(39.51)
a. Lack of personal acquaintance by teacher	108	20.41
b. Easier for shirker to get by	29	5.48
c. Foster misunderstandings (can't clarify points)	20	3.78
d. Difficult to check student progress	16	3.02
e. Marks depend too much on tests	9	1.70
f. Requires more effort on the part of instructor	5	.94
g. Better opportunity for student to copy	5	.94
h. Leads to more failures	5	.94
i. Poor instructor affects more students	4	.75
j. Difficulty of quizzing	2	.37
k. Inability of diagnosing individual student difficulties	2	.37
l. Forces exclusive use of objective tests	1	.18
m. More class time used in testing	1	.18
n. Difficulty of securing competent assistants	1	.18
o. Reporting of marks more difficult	1	.18

TABLE LIII—*Continued*

DISADVANTAGES OF LARGE CLASSES, ACCORDING TO STUDENTS

Items	Frequency of Mention	
	No.	Per Cent
IV. Effect on Students	(172)	(32.51)
a. Submerges timid students	38	7.18
b. Less student interest	32	6.04
c. Less individual attention	30	5.67
d. Less opportunity for student participation	16	3.02
e. Harder on slow student	15	2.83
f. Less spontaneity during class hour	15	2.83
g. Less class spirit	9	1.70
h. Best students are held back	4	.75
i. Students lump work (cooperate)	4	.75
j. Less student responsibility	4	.75
k. Greater opportunity for bluffing	3	.56
l. Individual differences waste time	2	.37

tioned. These were distributed among four major heads, as listed in Table LII. The disadvantages most frequently mentioned were concerned with the measurement and evaluation of results of instruction. Approximately 40 per cent of the topics fall under this head. General effect on students, with slightly more than 30 per cent, comes next. Then follow the deleterious effect upon instruction, with 20 per cent, and lack of proper physical facilities, with somewhat less than 7 per cent. Junior- and senior-college students are remarkably well agreed upon the relative importance of these major divisions.

The disadvantages of large classes are set forth in detail in Table LIII. Here we see that of improper physical facilities, only one—difficulty of hearing—is of any great importance. Under the effect upon instruction, there are nine sub-items, five of which are of some consequence. Probably few of the disadvantages of any sort are inherent in large classes. Most of them could probably be resolved if given the proper attention.

Tables LIV and LV list the ten disadvantages named most frequently by lower- and upper-classmen. Out of a total of 41 subdivisions with 262 items, the leading ten subdivisions include nearly 70 per cent of the upper-classmen and 61 per cent of the lower-classmen replies. Seven of the ten items are common to both

lists. Lack of personal acquaintance is decidedly the greatest objection; lack of opportunity for classroom discussion ranks second; and the restraining effect of large classes upon timid students is third. Again it may be doubted whether or not any of these disadvantages are inherent in large classes. Even if they are at present, it seems not unreasonable to assume that some of them at least may be overcome by the perfection of proper techniques of teaching and management.

TABLE LIV

DISADVANTAGES OF LARGE CLASSES MOST FREQUENTLY MENTIONED BY JUNIOR-COLLEGE STUDENTS

Items	Frequency of Mention	
	No.	Per Cent
*1. Lack of personal acquaintance by teacher	55	20.99
*2. Less classroom discussion possible	30	11.45
*3. Less student interest	18	6.87
*4. Less student attention	15	5.72
*5. Fosters misunderstanding (can't clarify points)	12	4.58
*6. Easier for shirker to get by	10	3.81
7. Difficulty of checking student progress	9	3.43
*8. Submerges timid student	9	3.43
9. Harder on slow student	8	3.05
10. Increases distractions	8	3.05
Total	174	66.38

* Starred items are common to both groups of students.

TABLE LV

DISADVANTAGES OF LARGE CLASSES MOST FREQUENTLY NAMED BY SENIOR-COLLEGE AND GRADUATE STUDENTS

Items	Frequency of Mention	
	No.	Per Cent
*1. Lack of personal acquaintance by teacher	53	19.85
*2. Submerges timid student	29	10.85
*3. Easier for shirker to get by	19	7.11
4. Less individual attention	15	5.61
*5. Less student interest	14	5.23
6. Less opportunity for student participation	13	4.86
*7. Less class discussion possible	13	4.86
*8. Less student attention	10	3.74
9. Less spontaneity during class period	10	3.74
*10. Fosters misunderstandings (can't clarify points)	8	2.99
Total	184	68.84

* Starred items are common to both groups of students.

TABLE LVI

Relative Distribution of Advantages among the Major Divisions

Major Divisions	Distribution of Student Opinion			
	Senior College and Graduate		Junior College	
	No.	Per cent	No.	Per cent
1. Economy	64	28.70	40	27.40
2. Instructor	39	17.49	30	20.55
3. Marking	29	13.00	11	7.53
4. Student	91	40.81	65	44.52
Total	223	100.00	146	100.00

Advantages of Large-Class Instruction

The students were also given an opportunity to list what they considered to be the advantages, if any, of large classes. These were tabulated under the four major heads given in Table LVI. A total of 369 advantages was mentioned, of which somewhat more than 42 per cent fell under the head of benefits to the student. Next in importance was economy, with 28 per cent; third, with 19 per cent, was the beneficial effect upon the instructor; while the remaining 11 per cent fell under the head of effects upon marking. As in the case of disadvantages, agreement between the groups was quite marked.

The detailed advantages are presented in Table LVII. Under economy are five subdivisions, the major one pertaining to money cost. Effect upon instructor includes six minor groupings, the chief one being the fact that since expansion of personnel is unnecessary, better instruction may be provided. Most important of the two items under the effect upon marking was the fact that larger groups permit more accurate relative grading. The greatest variety of responses was found under the effect upon students. Twelve sub-items were listed, of which the leading one was the provision for a greater variety of student reactions to the problems submitted for discussion.

Tables LVIII and LIX contain the ten subdivisions most often listed by each group of students. The agreement is about as close as that in the case of the disadvantages, there being seven subheads common to both lists.

TABLE LVII

ADVANTAGES OF LARGE CLASSES, ACCORDING TO STUDENTS

Items	Frequency of Mention	
	No.	Per Cent
I. Economy	(104)	(28.18)
a. Economy of cost	49	13.27
b. Economy of teachers' time in presenting material	29	7.85
c. Exploration of wider field of material	13	3.52
d. Less waste of student time through aimless discussion	11	2.98
e. Frees instructor for research	2	.54
II. Instructor	(69)	(18.69)
a. Permits fewer but better type of teacher	40	10.84
b. Permits higher standards	14	3.79
c. Stimulates instructor	6	1.62
d. Encourages more careful preparation	5	1.35
e. Dignifies subject	3	.81
f. Leads to more systematic presentation	1	.27
III. Marking	(40)	(10.84)
a. Permits more accurate relative grading	26	7.04
b. Brings more objective evaluation of student	14	3.79
IV. Student	(156)	(42.27)
a. Greater variety of student reactions	41	11.11
b. Fosters student initiative	33	8.94
c. Makes student competition keener	23	6.23
d. Gives broad contacts (wider fields)	20	5.42
e. Social stimulation (*esprit de corps*)	15	4.06
f. Permits student contact with great teachers	8	2.16
g. Stimulation of student by lectures	4	1.08
h. More enjoyable	4	1.08
i. Develops poise of student	3	.81
j. Checks monopoly of class by few students	2	.54
k. Student feels individual differences less	2	.54
l. Leads to greater student interest in subject	1	.27

ADMINISTRATIVE AND INSTRUCTIONAL AIDS

Question 25 asked the students to state frankly what, in their opinion, might have been done by either the administration or the instructor to improve conditions in the large classes that they had attended. Whether constructive or not, the responses were exceed-

large grouping in common. They are set forth in Tables LX and LXI, the former dealing with administration, the latter with instruction.

TABLE LVIII

ADVANTAGES OF LARGE CLASSES MOST FREQUENTLY NAMED BY JUNIOR-COLLEGE STUDENTS

Item	Frequency of Mention	
	No.	Per Cent
*1. Permits fewer but better type of teacher	19	13.01
*2. Fosters student initiative	16	10.95
*3. Economy in cost	16	10.95
*4. Greater variety of student reactions	13	8.90
*5. Economy of teacher's time in presenting material	11	7.53
6. Social stimulation (*esprit de corps*)	9	6.16
*7. Gives broader contacts	8	5.47
*8. More accurate relative grading	8	5.47
9. Less waste of student time through aimless discussion	8	5.47
10. Permits higher standards	7	4.79

* Starred items are common to both groups of students.

TABLE LIX

ADVANTAGES OF LARGE CLASSES MOST FREQUENTLY NAMED BY SENIOR-COLLEGE AND GRADUATE STUDENTS

Item	Frequency of Mention	
	No.	Per Cent
*1. Economy in cost	33	14.79
*2. Greater variety of student reactions	28	12.55
*3. Permits fewer but better type of teacher	21	9.41
*4. More accurate relative grading	18	8.07
*5 Economy of teacher's time in presenting material	18	8.07
*6. Fosters student initiative	17	7.62
7. Increases student competition	16	7.17
*8. Gives broader contacts	12	5.38
9. Brings more objective evaluation of student	11	4.93
10. Exploration of wider field of material	9	4.03

* Starred items are common to both groups of students.

TABLE LX

What Administration Could Have Done to Provide Better Conditions for Large Classes

Items	Student Opinions	
	No.	Per Cent
I. Provide Better Physical Facilities	(30)	(17.44)
a. Ventilation	8	4.65
b. Acoustics	7	4.06
c. Lighting	5	2.90
d. Seating (arrangement and numbering)	5	2.90
e. Place for wraps	2	1.16
f. Laboratory facilities	2	1.16
g. Library facilities	1	.58
II. Facilitate Classroom Work	(24)	(13.95)
a. Provide suitable instruction	16	9.30
b. Provide more assistants	2	1.16
c. Pay better salaries	1	.58
d. Schedule large classes in morning	1	.58
e. Allow no double-period large classes	1	.58
f. Facilitate transfers	1	.58
g. Classify students by ability	1	.58
h. Provide outside lecturers	1	.58
Total Administration Aids	54	31.39

Chief among the suggestions for improving large-class administration is provision for better physical facilities. Inadequate ventilation, poor acoustics, improper lighting, and unsuitable seating are the major complaints. Under the general heading of facilitating classroom work, the leading criticism was the failure carefully to select the instructor on the basis of suitability to large classes.

Nearly 70 per cent of the suggestions for improvement were leveled at the instructor. These are listed in Table LXI under the major heads of class management, of which adequate measurement of student work is outstanding; improvement of lectures, in which arousing interest is stressed; personal contacts, which reflects the need felt for consultations; subject matter; and, finally, technique. It is both significant and complimentary that instructional skill, which was earlier voted the most important asset of large-class teachers, here elicits the fewest expressions of dissatifaction. It seems that in the judgment of these students the most important

TABLE LXI

POSSIBLE INSTRUCTIONAL PROVISIONS FOR LARGE CLASSES

Items	Student Opinions	
	No.	Per Cent
I. Class Management	(47)	(27.34)
a. Secure fairer evaluation of student's work by:	14	8.13
1. Frequent examinations	5	
2. More objective marking	3	
3. Less emphasis on final examination	2	
4. Varying type of examination	1	
5. Allowing more time	1	
6. Returning test papers	1	
7. Less emphasis on term paper	1	
b. Encourage pupil participation	12	6.97
c. Discipline	9	5.23
1. Demand student respect and courtesy	3	
2. Demand reasonable quiet	3	
3. Maintain better discipline	2	
4. Require prompt attendance	1	
d. Avoid formality	3	1.74
e. Consider individual differences	2	1.16
f. Use socialized recitation	1	.58
g. More demonstrations	1	.58
h. Adequate supplementary material	1	.58
i. Check unimportant questions	1	.58
j. Adapt work to group	1	.58
k. Keep to subject	1	.58
l. Make pupil attendance optional	1	.58
II. Improve Lectures	(42)	(24.41)
a. Make lectures interesting	16	9.30
b. Voice	12	6.67
1. Louder	5	
2. More distinct	4	
3. Vary tone	2	
4. Speak more slowly	1	
c. Prepare and organize material better	4	2.32
d. Use frequent illustrations	3	1.74
e. Learn how to lecture (take courses)	2	1.16
f. Introduce humor (jokes and stories)	1	.58
g. Present material more slowly	1	.58
h. Clarify points	1	.58
i. Specialize for groups	1	.58
j. Avoid pounding on desk, etc.	1	.58

TABLE LXI—*Continued*

POSSIBLE INSTRUCTIONAL PROVISIONS FOR LARGE CLASSES

Items	Student Opinions	
	No.	Per Cent
III. Personal Contacts	(17)	(9.88)
a. Arrange for consultations	10	5.81
b. Maintain human relationships	4	2.32
c. Sympathize with student point of view	2	1.16
d. Avoid sarcasm	1	.58
IV. Subject Matter	(10)	(5.81)
a. Not too technical	4	
b. Eliminate duplication	2	
c. Avoid rehashing textbook material	2	
d. Make definite assignments	1	
e. Require less outside reading	1	
V. Technique in General	(2)	(1.16)
a. Work out special large-class technique	2	1.16
Total Instructional Aid	118	68.60

factor is being most effectively cared for by the University of Minnesota faculty.

ADDITIONAL TESTIMONY

At the close of his winter-quarter, 1926-27, class-size experiment in Physics (see Chapters VII and VIII), Professor Buchta requested his students in both the large and the small sections to hand in written statements or to come in and give him orally their reactions to class size. In his report to the subcommittee Dr. Buchta included two representative letters. They are reproduced here, with Professor Buchta's introductory comments.

PROFESSOR BUCHTA'S IMPRESSIONS

"The final averages and the individual comparisons (see Table CLXVIII) show that in the winter-quarter experiment under modified teaching procedures the size of the class had very little influence upon the final marks. My own general impression is that for weaker students the small class, with its possibility for more and repeated discussion, has some advantages; but in most cases the difference in marks can be attributed to causes other than class size.

"The first of the following letters was written by the seventh-

hour student (small class) of pair No. II, the second by the seventh-hour member of pair No. XI. It is to be noticed that the better student does not value the advantages of the small class as much as the weaker one does. It is the instructor's opinion that the writer of the second letter would not have passed had he been in the large class."

The First Letter

It is difficult for one not a student by nature or inclination to express a worth-while opinion on class size. I think that one's progress in a course depends upon a great many things more important than the size of the class. In Mechanics I find that some students consider outside study before class a necessity in a small group, whereas others maintain that discussion in a small class takes the place of outside work essential in a larger group. Again, the ability of the student determines in which group he will do better. Discussion in a small class makes clear many a fact the mere statement of which leaves no mental impression. But to other students, to whom the statement and its proof are sufficient, discussion is supererogative in that it serves only to slow up work and even sometimes to muddle things at first clear. The benefit derived from a course depends much upon the study outside of class; and one can and will do this, according to his nature, irrespective of the size of the class that he is in.

As to which size is better for the average student, I hardly know what an average student is, and at any rate there are few of him. It is hard to put every student in a class of his own kind, and yet this must be the way in which to give everyone the maximum value. Were this done all classes would be small.

Personally I like a small class because I find it easier to apply myself in such a group. Yet I dislike discussion and do not remember of asking a question once during the quarter. In some cases the discussion by others helped me to see a point more clearly; but usually I got the work by listening to the lecture and referring to the text to clear up doubtful points. I never studied the text before class. I found that whatever I did not understand was best cleared up by my figuring it out without the aid of either instructor or text. The size of the class makes little or no difference to me. As far as I have gone at the University of Minnesota I have received no other grade, higher or lower, than B, and as far as I can see I have had equal benefit, not maximum and yet not minimum, from classes which have been about equally divided between large and small.

From all this I draw only the conclusion that the benefit one gets from a course will be the same in any size of class if he applies himself and adjusts his methods to the class. I like a large class for the ground it covers, a small one for the ease of it, for its more interesting talks, and for the amount of work done in it. I have never formed a preference and

have been equally well satisfied in any size of class, provided the instructor was fitted to teach the particular size of class in which he found himself.

The Second Letter

I am very much in favor of a small class in any course, especially in Physics, because it gives the slow-thinking student a greater chance thoroughly to understand the subject. Questions can be asked and answered as they come up and a more thorough understanding of the whole subject can be had because the explanations are given to benefit those students who have troubles in common. In a large class the professor perhaps has an idea of the points which are not clear, but sometimes misses the phases which really bother.

The only objection I can see which amounts to anything is that of securing adequate or able instructors for small classes, as there are so few students in a small class that it would be quite expensive.

Summary of Student Testimony

In the first inquiry, instigated by the instructors, from 65 to 100 per cent of the students in four large College of Education classes expressed either a qualified or an outright preference for small classes. The most frequent reason offered by those who unqualifiedly favored large classes was the increased opportunity for contact, student with student. The modal objection to large classes was that they cause embarrassment owing to the necessity of having to shout to make one's self heard. The most frequent qualified reaction was that large classes are better for lecture courses, small classes for all other occasions.

To the second inquiry, made by a senior student, 122 freshmen, juniors, and seniors responded. Two preferred large classes, 4 were indifferent, and 116 favored small classes. The prevailing arguments in support of large classes were that (1) they evoke more varied responses, (2) the marks are not based upon prejudices, and (3) instructors prepare better for large classes. The four students who assumed a neutral attitude felt that the instructor, and not class size, is the determining factor. The prevailing reactions in favor of small classes were that they afforded (1) closer personal contact, student with instructor, (2) less chance to bluff, (3) more personal attention, (4) stimulation of interest and independent thinking, and (5) more opportunities for informal discussion.

In the third inquiry, instigated by the subcommittee on class

size, 200 student responses to a questionnaire were tabulated. The sampling, limited to students who had had experience with both large and small classes, included 16 graduates, 34 seniors, 50 juniors, 35 sophomores, and 65 freshmen, and represented 37 major fields of study. The median number of large classes that these students had attended was 7; the median number of small classes, 6. Forty-seven per cent of the students preferred small classes, 35 per cent favored the medium-sized, and 12 per cent preferred the large.

In the statements which follow, the modal replies are given as representing the typical student. The optimum size of class for the various levels and types of courses was:

	Junior College	Senior College	Graduate
Lecture classes	105	75	50
Recitation classes	25	20	15
Laboratory classes	30	20	15

In general, the student believes that large classes yield the least satisfactory marks, small classes the most satisfactory.

He believes that the more aggressive and superior type of student is favored by large classes, the inferior and timid student by small.

For large classes he prefers instructors who are first of all magnetic lecturers but who also have a broad, accurate knowledge of their subjects, well-organized courses, power to interest their listeners, and a flair for handling discussion. They should, moreover, have an accurate sense of proportion and an abiding interest in both students and subject matter.

The large class should be offered primarily as a lecture course, but the lectures should be frequently interspersed with some form of discussion or quizzing.

The student feels the need of personal contact with his instructors more in large classes than in small and would like the opportunity of conferring with them whenever he feels the need of such interviews, which are usually initiated by him.

The value of a course to the typical student is not directly contingent upon actual participation in the class procedure.

His chief objections to large classes are the lack of personal acquaintance with his instructors, the impossibility of hearing sufficient classroom discussion, and the general lack of personal attention, especially in the matter of checking student progress.

The chief advantages realized in large classes are the opportunity for contacts with other students and with great teachers, the stimulation of student initiative, and economy in cost.

In his opinion the administration could improve large-class conditions by providing better physical facilities, such as ventilation, lighting, and seating, and by making a more careful selection of instructors for large classes.

In the opinion of the student, the chief factor in the improvement of large-class conditions is the instructor himself. He should secure a fairer evaluation of the student by more frequent examinations; encourage pupil participation; maintain discipline; arrange a definite time for consultations; and improve his lectures by making them more interesting, by speaking more distinctly, by using illustrations more frequently, and by making his treatment of subject matter less complicated by technicalities.

The majority of the students in the winter-quarter, 1926-27, experiment in Physics favored small classes after the experiment was concluded. The typical reaction of those who either preferred large classes or were indifferent was that class size is relatively immaterial if instructors and students conscientiously adapt themselves and their methods to the size of the class.

All in all, under-classmen crave the acquaintance of their instructors most and upper-classmen least. Both, however, welcome the better opportunity which they feel that small classes afford them of making closer personal contacts with their teachers.

In general, the weaker a student is the more he feels that it would be to his interest to get personally acquainted with his instructors. He therefore prefers small classes because he believes that in them he can make the desired contacts more readily and effectively.

Capable students repeatedly insinuate that weak students prefer small classes because of the greater likelihood afforded them of inducing their instructors to condone their shortcomings. There is some evidence in support of this claim.

Capable students frequently assert that their classmates who are scholastically inconspicuous but prominent in extra-curricular affairs welcome the opportunity, which they feel is greater in small classes, of exhibiting their extrovert tendencies before their instructors in personal conference.

Most superior students are either ignorant of the fact that they are already best known by their instructors or would like to become still better known, for they prefer small classes in the belief that they afford better opportunities for making contact with instructors.

CHAPTER VI

FACULTY TESTIMONY

The preliminary semicontrolled investigation of the relative effect of class size on marks, reported in Chapter IV, pointed to the suspicion that the size of the class is of minor importance and that students in large classes achieve not only as well as those in small groups but in many cases actually do better. Merely to increase the physical size of classes is not, however, necessarily a guarantee of greater efficiency. The total situation should be analyzed and the factors dominant in the success of large classes should be determined.

At the University of Minnesota, as in other rapidly growing institutions of higher learning, large classes, organized either through accident or design, have long been maintained in many diverse fields. It seems reasonable to believe that those instructors who have had considerable experience with such classes should best be able to shed light on advantages and disadvantages of large classes. Accordingly, a carefully planned seven-page questionnaire, a copy of which appears in the Appendix, was submitted to all faculty members in the University. Approximately 750 copies were sent out. No sampling was resorted to because it was desired to give every instructor a fair hearing and a full opportunity to add his weight of evidence.

Character of Teaching Population Represented in Tabulations

Since time was pressing, it was decided to limit the tabulations to the first 150 reasonably complete returns from instructors who had had experience with large classes. In order to prevent prejudicial influences on the tabulations, the criterion of completeness was applied by an entirely unbiased observer. Unfortunately many excellent returns could not be included in the present report because they were received after the tabulations were completed.

As was desired, the responses were received from widely varied fields and extremely diverse interests. It is believed that they may safely be taken as representative of current faculty reactions

TABLE LXII

Distribution by Collegiate Divisions and by Ranks of Instructors Whose Replies Are Tabulated

Collegiate Divisions	No. of Departments Represented	Professor	Associate Professor	Assistant Professor	Instructor	Lecturer	Assistant	Total	Per Cent
Science, Literature, and the Arts........	15	21	8	13	14	....	2	58	38.7
Agriculture	7	6	2	3	3	....	....	14	9.3
Home Economics	1	....	2	....	4	....	....	6	4.0
Engineering	7	8	2	7	5	....	....	22	14.7
Education	8	4	3	4	2	2	....	15	10.0
Business	5	3	2	4	2	....	....	11	7.3
Medicine	6	6	2	....	2	....	....	10	6.7
Chemistry	3	1	1	4	1	....	....	7	4.7
Law	1	4	....	....	....	....	....	4	2.7
Extension	3	....	1	1	1	....	....	3	2.0
Total	56	53	23	36	34	2	2	150	
Per Cent		35.3	15.3	24.0	22.7	1.3	1.3		

at the University of Minnesota. The complete distribution of replies that figure in the tabulations is shown in Table LXII. Eleven collegiate divisions and fifty-six separate departments are represented. The distribution among departments is also wide enough that no one department or type of department can dominate the results. Interests range from philosophy to farming and from music to mechanical drawing. Professional ranks range from teaching assistants to full professors.

TABLE LXIII

CLASS PREFERENCE OF INSTRUCTORS CLASSIFIED BY COLLEGIATE DIVISIONS

Collegiate Divisions	Type of Class Preferred				
	Large	Medium	Small	Immaterial	Total
Science, Literature, and the Arts	7	30	10	11	58
Engineering	4	12	4	2	22
Education	6	5	1	3	15
Agriculture	....	12	2	....	14
Business	....	7	2	2	11
Medicine	2	5	1	2	10
Chemistry	....	2	1	4	7
Home Economics	....	6	....	....	6
Law	1	1	1	1	4
Extension	1	1	1	....	3
Total	21	81	23	25	150
Per Cent	14.0	54.0	15.3	16.7	100.0

Class-Size Preference

Since the questionnaire was concerned primarily with distinctions between large- and small-class procedures and experiences, it was decided to group the replies in accordance with the answers to the following question: Which size of class, large, medium, or small, do you prefer to teach?

Of the 150 instructors, 21, or 14 per cent, preferred to teach large classes; 81, or 54 per cent, preferred the medium-sized class; 23, or 15 per cent, favored the small class; and 17 per cent were indifferent. It will be observed that large and small classes were preferred by approximately the same number of instructors. The overwhelming choice is in favor of medium-sized classes.

Distribution by colleges is exhibited in Table LXIII. On the whole, preferences are fairly well scattered throughout all collegiate divisions. Notable exceptions occur in Agriculture, Business, Chemistry, and Home Economics. Out of 35 instructors from these divisions, none prefer the large, 5 prefer the small, 27 favor the medium, and with 6 the size is immaterial.

TABLE LXIV

MEDIAN LIMITS OF CLASS SIZE ESTABLISHED BY ENTIRE GROUP OF FACULTY MEMBERS

Collegiate Division	Predominant Type of Class	Number of Students to Be Considered as the Upper Limit of Small Class		Lower Limit of Large Class		Optimum (Ideal) Size of Class	
1. Junior College	Lecture	35	(62)	50	(67)	75	(69)
	Recitation	20	(96)	30	(92)	25	(92)
	Laboratory	15	(46)	20	(42)	20	(48)
2. Senior College	Lecture	30	(75)	50	(79)	40	(71)
	Recitation	20	(98)	27½	(90)	20	(90)
	Laboratory	15	(64)	20	(59)	15	(63)
3. Graduate	Lecture	20	(55)	25	(54)	20	(49)
	Recitation	15	(66)	20	(61)	15	(61)
	Laboratory	10	(45)	15	(40)	10	(39)

Numbers in parentheses indicate number of judgments recorded.

TABLE LXV

MEDIAN STUDENT OPINION CONCERNING CLASS LIMITS

Collegiate Division	Predominant Type of Class	Number of Students to Be Considered as the Upper Limit of Small Class		Lower Limit of Large Class		Optimum (Ideal) Size of Class	
1. Junior College	Lecture	50	(149)	100	(149)	105	(148)
	Recitation	25	(170)	35	(157)	25	(170)
	Laboratory	30	(111)	40	(110)	30	(111)
2. Senior College	Lecture	50	(93)	75	(87)	75	(86)
	Recitation	25	(98)	30	(99)	20	(94)
	Laboratory	25	(14)	30	(64)	20	(63)
3. Graduate	Lecture	35	(40)	40	(39)	50	(41)
	Recitation	15	(47)	25	(46)	15	(49)
	Laboratory	15	(33)	20	(33)	15	(37)

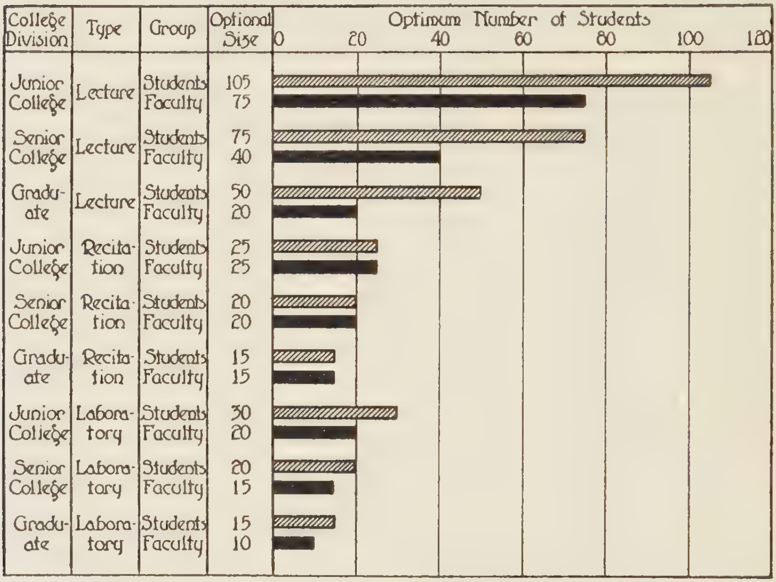
Numbers in parentheses indicate number of judgments recorded.

The bulk of the following tables, where subclassifications are presented, will be divided according to the instructor's preference. In column headings where abbreviations are necessary, the initial

letters L for Large, M for Medium, S for Small, and I for Immaterial will be used.

FIGURE 11

COMPARISON OF MEDIAN JUDGMENTS OF STUDENTS AND FACULTY AS TO OPTIMUM SIZE OF CLASSES SUITED TO VARIOUS TYPES OF INSTRUCTION, UNIVERSITY OF MINNESOTA, 1927



Expression of Class Limits

To provide a common basis of interpretation, the same question regarding class limits as was asked of the students was submitted to the faculty. The median replies of the entire group are listed in Table LXIV. The last column, indicating the optimum (ideal) size of class, is of special interest. Two types of courses, junior-college lecture and junior-college laboratory, fall definitely in the division of large classes. The remaining seven all reside in the medium-sized classification. This is consistent with the expression of class preference in which it will be recalled that 81 instructors, or 54 per cent of those whose replies were tabulated, expressed a general preference for medium-sizes classes.

The limits indicated in the table are quite conservative due to the fact that the opinions of instructors from all departments and types, laboratory as well as predominantly recitation, are combined. The conservatism of the faculty is apparent when their reactions are compared to those of the students. To facilitate this contrast, the median limits proposed by students are reproduced in Table LXV. Figure 11 presents a comparison of the optimum size for each of the various types as indicated by both the students and the faculty.

Disagreement is most marked in the case of lecture groups, the students being far more liberal. The discrepancies are really nearly as significant in the case of laboratory sections, the relative differences not being so apparent due to the smaller numbers. Agreement is perfect in the case of recitation sections.

TABLE LXVI

Median Limits of Class Size Established by Faculty Men Who Favor the Large Size

Collegiate Division	Predominant Type of Class	Number of Students to Be Considered as the		
		Upper Limit of Small Class	Lower Limit of Large Class	Optimum (Ideal) Size of Class
1. Junior College	Lecture	50 (7)	50 (11)	125 (9)
	Recitation	20 (12)	40 (9)	85 (8)
	Laboratory	15 (8)	17½ (4)	15 (7)
2. Senior College	Lecture	27½ (10)	50 (11)	100 (11)
	Recitation	20 (15)	30 (10)	35 (11)
	Laboratory	15 (13)	20 (11)	15 (9)
3. Graduate	Lecture	20 (11)	30 (9)	50 (9)
	Recitation	20 (12)	20 (7)	25 (15)
	Laboratory	5 (9)	10 (5)	10 (3)

Numbers in parentheses indicate number of judgments recorded.

Table LXVI provides the median opinion of only those instructors who prefer large classes. The contrasts with other groups appear to be largely in the size of the lecture and recitation classes. The number of cases is so small, however, that little significance should be attached to the figures. In contrast, the median opinion of those instructors who favored small classes is set forth in Table LXVII. Again the numbers are too few to be more than suggestive. Perhaps the chief significance of the optimum figures

does not inhere in the numbers themselves. The combination is of too heterogeneous a nature to permit of the median's being directly applied to any given field. It is our belief that the maximum value is attached to the suggested ratio of size among the various types of classes.

TABLE LXVII

MEDIAN LIMITS OF CLASS SIZE ESTABLISHED BY THOSE FACULTY MEN WHO FAVOR THE SMALL SIZE

Collegiate Division	Predominant Type of Class	Number of Students to Be Considered as the		
		Upper Limit of Small Class	Lower Limit of Large Class	Optimum (Ideal) Size of Class
1. Junior College	Lecture	30 (7)	40 (6)	55 (8)
	Recitation	20 (12)	30 (12)	20 (12)
	Laboratory	15 (2)	17½ (2)	15 (2)
2. Senior College	Lecture	25 (7)	40 (7)	25 (7)
	Recitation	20 (10)	27½ (10)	20 (11)
	Laboratory	12½ (4)	22½ (4)	15 (5)
3. Graduate	Lecture	20 (3)	30 (3)	25 (2)
	Recitation	15 (6)	20 (6)	10 (7)
	Laboratory	5 (3)	15 (3)	5 (3)

Numbers in parentheses indicate number of judgments recorded.

TABLE LXVIII

EXPERIENCE WITH LARGE CLASSES, CLASSIFIED BY COLLEGIATE DIVISION OF INSTRUCTORS

Collegiate Division	Number of Large Classes Taught			
	1	2-10	Over 10	Total
Science, Literature, and the Arts	2	35	21	58
Engineering	4	12	6	22
Education	3	5	7	15
Agriculture	3	8	3	14
Business	1	6	4	11
Medicine	1	1	8	10
Chemistry	1	2	4	7
Home Economics	2	3	1	6
Law	....	1	3	4
Extension	....	3	....	3
Total	17	76	57	150
Per Cent	11.3	50.7	38.0	100.0

TABLE LXIX

Relation between Size of Class Preferred and Number of Large Classes Taught

Number of Large Classes Taught	Size of Class Preferred				
	Large	Medium	Small	Immaterial	Total
1-	1	11	1	2	15
2-10	4	45	15	14	78
11-	16	25	7	9	57
Total	21	81	23	25	150
Median	11+	8.1	8.1	8.8	8.9

Large-Class Experience

As was stated previously, the tabulations were confined to those faculty members who signified experience with large classes in college. That this experience is common to all divisions of the University is indicated by the wide distribution in Table LXVIII. Of the entire group, 11.3 per cent have taught only one large class. Slightly more than half have taught from two to ten large classes, and 38 per cent have taught eleven or more. The Medical School appears to have the largest percentage of large classes and the Extension Division the smallest.

Experience and Preference

What is the relation between the number of large classes taught and instructors' preferences toward class size? Table LXIX shows that the group which prefers large classes has taught the largest median number of such classes. The group which has taught the next highest median number of large classes says that size is immaterial. Beyond that no relationship is apparent.

The departments were divided into two groups, those predominantly laboratory, and others. Table LXX shows for these two groups and also for all departments combined the relation between the approximate size of the largest class taught and the instructor's preference. With the exception of the laboratory group, the median size of the largest class is greatest for those who prefer to teach such classes. The next largest is in the group that has no preference.

TABLE LXX

Distribution of Approximate Sizes of Largest Class Taught by Instructors, Classified According to Departments Predominantly Laboratory, Other Type, and Total

Predominant Type of Department	Size of Class Preferred by Instructor	Size of Largest Class Taught											
		6-15	16-20	21-30	31-40	41-50	51-75	76-100	100-200	201-	No Reply	Total	Median
Laboratory	Large	....	....	....	....	2	....	2	7	....	....	11	122.4
	Medium	1	1	6	8	7	11	2	10	....	....	46	51.0
	Small	....	....	2	2	....	2	2	1	....	....	9	57.5
	Immaterial	....	....	....	....	1	....	2	5	1	....	9	131.0
	Total	1	1	8	10	10	13	8	23	1	....	75	
Other	Large	....	....	....	....	1	1	....	6	2	....	10	151.0
	Medium	....	....	....	5	8	5	7	3	6	1	35	71.0
	Small	....	....	....	5	1	2	....	3	2	1	14	57.3
	Immaterial	....	....	1	2	....	3	2	4	4	....	16	101.0
	Total	....	....	1	12	10	11	9	16	14	2	75	
Total	Large	....	....	....	....	3	1	2	13	2	....	21	134.6
	Medium	1	1	6	13	15	16	9	13	6	1	81	57.3
	Small	....	....	2	7	1	4	2	4	2	1	23	57.3
	Immaterial	....	....	1	2	1	3	4	9	5	....	25	116.7
	Total	1	1	9	22	20	24	17	39	15	2	150	62.5

TABLE LXXI

Year in Which Largest Class Was Taught

Year	Preference of Instructor					
	Large	Medium	Small	Immaterial	Total	Per Cent
1926	9	27	4	12	52	34.7
1925	3	10	8	3	24	16.0
1924	5	7	1	2	15	10.0
1923	2	5	3	1	11	7.3
1922	....	3	1	....	4	2.7
1921	....	3	....	....	3	2.0
1920	....	4	2	2	8	5.3
1919	1	11	3	2	17	11.3
1909	....	2	....	1	3	2.0
No reply	1	9	1	2	13	8.7
Total	21	81	23	25	150	100.0

TABLE LXXII

Predominant Type of Course in Which Largest Class Was Taught, Classified by Instructor's Preference as to Size of Class

Predominant Type of Course	Size of Class Preferred by Instructor					
	L	M	S	I	Total	Per Cent
Lecture	18	45	11	19	93	46.3
Laboratory	3	25	4	7	39	19.4
Recitation	5	35	13	8	61	30.3
Other	2	3	3	....	8	4.0
Total	28	108	31	34	201	100.0

TABLE LXXIII

Predominant Type of Student in Largest Class Taught, Classified by Instructor's Preference as to Size of Class

Predominant Type of Student	Size of Class Preferred by Instructor					
	L	M	S	I	Total	Per Cent
Freshman	3	26	8	7	44	20.8
Sophomore	8	37	9	11	65	30.8
Junior	10	28	4	11	53	25.1
Senior	8	19	3	6	36	17.1
Graduate	2	6	3	2	13	6.2
Total	31	116	27	37	211	100.0

TABLE LXXIV

PREDOMINANT TYPE OF LARGEST CLASS, ELECTIVE OR REQUIRED, AND NEW OR WELL-ESTABLISHED

Predominant Type of Course	Preference					
	L	M	S	I	Total	Per Cent
Elective	8	36	5	9	58	40.8
Required	13	42	15	14	84	59.2
Total	21	78	20	23	142	100.0
New	1	5	4	3	13	11.4
Well-established	13	55	15	18	101	88.6
Total	14	60	19	21	114	100.0

Table LXXI shows the year in which the instructor's largest group was taught. It is evident that the tide of students is still rising, since more than half of the instructors have taught their largest class within the last two years.

As might be expected, the largest class for 46 per cent of the instructors was predominantly a lecture course (Table LXXII). The students in it were mostly sophomores, although there were no hard and fast lines drawn and usually the group was composed of representatives from two or more classes, the most favored combination being freshmen and sophomores or juniors and seniors, etc. (Table LXXIII). The course was usually required and was well established, as Table LXXIV reveals.

The most frequent single reason for the extraordinary size of the class was heavy student election (Table LXXV). There being too few teachers (28.4 per cent), the department budget not permitting expansion (21.1 per cent), or there being insufficient classrooms available (6.8 per cent), no additional sections were scheduled. Few large classes were inaugurated at the request of the instructor and only 2 per cent were organized as experiments. It is slightly significant of the growing scientific attitude of most college teachers to find this last reason given by representatives of all preference groups.

Does actual contact with large groups tend to change an instructor's attitude toward such groups? More than one-third of those replying to this question say that it does (Table LXXVI).

Several instructors testified that they approached the question with extreme skepticism but that from actual experience became enthusiastic over the possibilities in larger groups. The remaining two-thirds averred that a trial with large groups made no change in their attitude.

Measurement of Results

The factors upon which final marks are based are set forth in Table LXXVII. Gross accomplishment heads the list, 143, or 82 per cent, of the 150 instructors using it as one basis for the determination of marks. Sixty-four, or 43 per cent, put a premium upon initiative and originality and 59 per cent take account of the students' improvement in the subject. In the judgment of 62 instructors, or 42 per cent, industry and application have some weight, while 39 per cent reward participation in class discussions. Thirty-six per cent stated that mental ability is a factor, although several said that the direct criterion was the expression of mental ability through the media of some of the other factors checked. One-fourth of the group considered regularity of attendance a worthy factor in marking, while 8 per cent gave a definite place to maturity. Despite the wide range of factors and the subjective nature of some of them, one gains the general impression that, on

TABLE LXXV

Reason for Organization of Large Class

Reason	Preference					
	L	M	S	I	Total	Per Cent
Heavy student enrollment	12	35	6	12	65	34.2
Too few teachers	8	30	6	10	54	28.4
Economy	11	17	8	4	40	21.1
Shortage of classrooms	3	8	....	2	13	6.8
At your request	3	3	....	1	7	3.7
As an experiment	1	1	1	1	4	2.1
Mistake by registrar	....	1	....	1	2	1.1
Precedent—traditional method	....	1	....	1	2	1.1
S.A.T.C. under war-time conditions	....	....	1	....	1	.5
To give teaching experience to advanced students	....	....	....	1	1	.5
Survey course which was required	....	....	1	....	1	.5
Total	38	96	23	33	190	100.0

the whole, a sincere attempt is being made to assign marks as fairly as possible in the light of each instructor's standards for securing such marks.

TABLE LXXVI

CHANGE IN ATTITUDE TOWARD LARGE CLASS

	Preference					
	L	M	S	I	Total	Per Cent
Yes	3	7	3	3	16	34.8
No	5	15	2	8	30	65.2
Total	8	22	5	11	46	100.0

TABLE LXXVII

FACTORS UPON WHICH FINAL MARKS ARE BASED

Factors	Preference					
	L	M	S	I	Total	Per Cent
Gross accomplishment in subject	21	78	21	23	143	82.0
Initiative and originality	12	53	17	13	95	64.0
Improvement in subject	7	46	12	8	73	49.3
Industry and application	7	39	9	7	62	42.0
Participation in class discussion	4	36	10	8	58	39.3
Mental ability	7	32	9	5	53	36.0
Regularity of attendance	4	25	4	4	37	25.3
Class—i.e., undergraduate or graduate	2	10	1	5	18	12.7
Personality of student	3	7	1	4	15	10.0
Maturity	1	4	3	3	11	8.0
Attitude toward teacher	....	5	1	1	7	4.7
Attitude toward subject	1	1	1	....	3	2.0
Care in analyzing work	....	1	1	....	2	1.3
Attention to details	....	1	1	....	2	1.3
Approximation to a theoretical standard	....	....	1	....	1	.7
Purpose in taking course	....	1	....	....	1	.7
Total	69	339	92	81	581	

The range of devices used to measure accomplishment is almost as wide (Table LXXVIII). The most frequent method is by means of short quizzes, 73 per cent of the instructors using this device. The second most frequently mentioned, employed by 66

TABLE LXXVIII

Devices Used to Measure Accomplishment

Devices	Preference					
	L	M	S	I	Total	Per Cent
Frequent short quizzes	17	60	12	20	109	72.7
Objective final examination	12	51	18	18	99	66.0
Essay-type of final examination	12	39	10	15	76	50.7
Objective mid-quarter examination	10	34	13	13	70	46.7
Frequent problems	12	36	7	10	65	43.3
Class discussion	7	37	10	10	64	42.7
Essay-type mid-quarter examination	7	30	7	12	56	37.3
Personal conferences	8	30	7	4	49	32.7
Notebooks	6	27	4	10	47	31.3
Term papers	4	24	6	10	44	29.3
Class reports	5	17	4	3	29	19.3
Demonstrations	3	10	....	4	17	11.3
Semi-objective examinations	....	4	....	....	4	2.7
Laboratory reports and work	....	1	....	2	3	2.0
Board work in language courses	....	1	....	....	1	.7
Total	103	401	98	131	733	

TABLE LXXIX

Devices Used to Measure Accomplishment Which Are Particularly Adapted to Large Classes

Devices	Preference					
	L	M	S	I	Total	Per Cent
Objective final examinations	8	20	8	8	44	25.9
Frequent short quizzes	7	22	2	6	37	21.8
Objective mid-quarter examination	5	13	5	4	27	15.9
Frequent problems	4	7	1	3	15	8.8
Essay-type final examination	3	6	2	....	11	6.5
Essay-type mid-quarter examination	1	5	1	....	7	4.1
Term papers	....	4	2	1	7	4.1
Personal conferences	....	3	2	1	6	3.5
Class discussions	1	3	....	2	6	3.5
Notebooks	1	3	....	1	5	2.9
Class reports	....	....	1	1	2	1.2
Demonstrations	....	2	....	....	2	1.2
Laboratory reports and work	....	1	....	....	1	.6
Total	30	89	24	27	170	100.0

per cent of the instructors, is the objective final examination. Third in popularity is the essay type of final examination, used at least in part by slightly over one-half of the instructors. Objective mid-quarter examinations are employed by about 47 per cent, and frequent problems and class discussions are given a place by slightly more than four-fifths of the group.

It appears that, all in all, the task of measuring accomplishment is done rather painstakingly. Each instructor employs, on the average, five separate devices to gain the same end, one of them being an objective examination of some type. Instructors who prefer small classes make less use of the frequent short quiz, more use of the objective mid-term and final examination, and slightly more relative use of class discussion, although the difference in this last factor is not a marked one.

Instructors were asked to indicate which devices were especially applicable to measurement of achievement in large classes. The replies are summarized in Table LXXIX. Objective final and mid-quarter examinations and frequent short quizzes are the ones most frequently mentioned. Nine per cent included frequent problems and 4 per cent favored term papers. Only 3.5 per cent believed that personal conferences are adapted to the measurement of results in large classes, and 3.5 per cent also listed class discussions.

Assistance

In the opinion of the subcommittee, adequate clerical and teaching assistance is essential to the success of large-class program. Any plan which imposes an increased student-credit-hour load on the instructor without at the same time relieving him of the thousand and one details which may better be handled by some less expensive assistant, is doomed to failure. Instructors are justified in expecting such provision.

That such a plan is generally in force at Minnesota is indicated by Table LXXX, in which two-thirds of the instructors acknowledge assistance in handling their classes. Approximately two-thirds of them also state that this assistance is entirely outside the classroom, while the others indicate that at least a part of the help is actual classroom aid (Table LXXXI). The assistance in 58 per cent of the cases was rendered by a graduate student, in 29 per

cent by an instructor, and in the remaining 13 per cent by other agencies, usually desultory clerical help (Table LXXXII).

TABLE LXXX

ASSISTANCE IN CONDUCTING LARGE CLASSES

Replies	Preference					
	L	M	S	I	Total	Per Cent
Yes	18	48	14	21	101	67.4
No	3	27	7	4	41	27.3
No reply		6	2		8	5.3
Total	21	81	23	25	150	100.0

TABLE LXXXI

WHO ASSISTED IN CONDUCTING LARGE CLASSES?

Replies	Preference					
	L	M	S	I	Total	Per Cent
Graduate student	12	32	11	17	72	58.1
Instructor	7	18	5	6	36	29.0
Other	5	7	2	2	16	12.9
Total	24	57	18	25	124	100.0

TABLE LXXXII

WAS ASSISTANCE ALL OUTSIDE OF CLASSROOM?

Reply	Preference					
	L	M	S	I	Total	Per Cent
Yes	9	24	10	12	55	64.7
No	9	15	2	4	30	35.3
Total	18	39	12	16	85	100.0

Instructors were asked to indicate the nature of the assistance which they had actually received. The responses were tabulated according to the following scheme of classification:

I. Teaching Aids
   A. Taking class during absence of instructor
   B. Lecture assistance
   C. Handling quiz and discussion sections
   D. Assisting in laboratory instruction
      1. Aiding in direction of laboratory work
      2. Assisting with experiments

II. Marks
   A. Reading papers
   B. Keeping records
   C. Recording marks
   D. Reporting marks

III. Material
   A. Preparing illustrations
   B. Preparing mimeographed materials
   C. Preparing for demonstrations

IV. Mechanics
   A. Taking roll
   B. Caring for light, ventilation, etc.
   C. Passing and collecting papers

Forty-seven per cent of the assistance had to do directly with student marks (Table LXXXIII). This is more than twice as much as any other kind of aid.

In reply to the question concerning the kind of assistance most helpful to large-class instructors, the item of Marks, with 55 per cent, again far outdistanced the other categories (Table LXXXIV). Teaching Assistance, with 17 per cent, was considered next most helpful; Materials, with 15 per cent, next; and Mechanics, with 13 per cent, least valuable.

TABLE LXXXIII

NATURE OF ASSISTANCE IN CONDUCTING LARGE CLASSES

Replies	Preference					
	L	M	S	I	Total	Per Cent
Marks	18	44	14	19	95	47.1
Mechanics	9	20	4	7	40	19.8
Materials	9	16	5	6	36	17.8
Teaching	5	14	3	9	31	15.3
Total	41	94	26	41	202	100.0

TABLE LXXXIV

KIND OF ASSISTANCE CONSIDERED MOST USEFUL AS AID TO LARGE-CLASS INSTRUCTION

TYPE	PREFERENCE					
	L	M	S	I	Total	Per Cent
Teaching	5	18	1	5	29	17.2
Marks	15	48	13	16	92	54.4
Materials	3	15	4	4	26	15.4
Mechanics	3	10	4	5	22	13.0
Total	26	91	22	30	169	100.0

TABLE LXXXV

BEST TYPE OF SEAT

TYPE OF SEAT	PREFERENCE					
	L	M	S	I	Total	Per Cent
Table arm	10	26	6	9	51	56.0
Fixed—rigid	2	5	1	6	14	15.4
Comfortable	1	6	....	1	8	8.8
Immaterial	1	3	....	2	6	6.6
Hard, straight back	3	1	1	....	5	5.5
Benches at tables	1	1	1	....	3	3.3
Individual	....	2	1	....	3	3.3
Short, without arms	....	....	....	1	1	1.1
Total	18	44	10	19	91	100.0

TABLE LXXXVI

BEST TYPE OF SEAT ARRANGEMENT

SEAT ARRANGEMENT	PREFERENCE					
	L	M	S	I	Total	Per Cent
Circular	10	22	6	14	52	60.5
Immaterial	3	10	2	4	19	22.1
Straight rows	4	4	4	2	14	16.3
Other	....	....	1	....	1	1.1
Total	17	36	13	20	86	100.0

TABLE LXXXVII

Best Type of Floor

Type of Floor	Preference					
	L	M	S	I	Total	Per Cent
Pitched	17	34	13	15	79	74.5
Level	1	6	1	5	13	12.3
Immaterial	1	5	1	1	8	7.5
Qualified	5	1	....	....	6	5.7
Total	24	46	15	21	106	100.0

TABLE LXXXVIII

Best Type of Artificial Lighting

Type of Lighting	Preference					
	L	M	S	I	Total	Per Cent
Indirect	6	18	5	9	38	65.5
Semi-direct	4	5	2	....	11	19.0
Overhead	....	4	....	1	5	8.6
Diffused strong light	1	1	1	....	3	5.2
Side lights	....	1	....	....	1	1.7
Total	11	29	8	10	58	100.0

TABLE LXXXIX

Is Raised Platform for Instructor an Advantage?

Faculty Opinions	Preference					
	L	M	S	I	Total	Per Cent
Yes	13	40	14	16	83	75.5
No	5	11	1	5	22	20.0
Qualified	1	4	....	....	5	4.5
Total	19	55	15	21	110	100.0

TABLE XC

Provision for Illustrative Material

	Preference					
	L	M	S	I	Total	Per Cent
Blackboard	7	15	4	7	33	28.2
Lantern, provision	9	14	2	8	33	28.2
Chart hanger	4	12	5	6	27	23.1
Maps and globes	3	7	....	4	14	12.0
Ample laboratory supplies in a convenient case	2	5	....	1	8	6.8
Bulletin boards	1	....	1	....	2	1.7
Total	26	53	12	26	117	100.0

Physical Conditions

The type of seat best adapted to large classes, according to 56 per cent of those replying, is one with a movable tablet arm (Table LXXXV). Fifteen per cent of the instructors would have it rigid. Nine per cent agree that the seat should be comfortable, while 6 per cent maintain that the seat should have a straight, hard back. Slightly more than 60 per cent hold that the seats should be arranged in circular rows, 22 per cent believe that the arrangement is not a matter of moment, while 16 per cent would have straight rows (Table LXXXVI). This factor is very closely related to the question of the size of the group.

As to the classroom floor, 74 per cent would have it pitched, 12 per cent favor level floors, and the rest think it makes no difference (Table LXXXVII).

The most popular type of artificial lighting is indirect, although quite a number favor the semidirect. Five merely stipulated that the light should come from overhead (Table LXXXVIII).

The plan of having a raised platform for the instructor was commended by about three-fourths of the instructors who replied (Table LXXXIX).

TABLE XCI

Other Room Conditions Mentioned as Important

Conditions	Preference					
	L	M	S	I	Total	Per Cent
Ventilation	15	37	11	13	76	46.9
Uniform temperature	4	13	6	4	27	16.6
Freedom from outside noises	3	14	6	3	26	16.1
Acoustics	1	5	3	5	14	8.6
Provision for wraps	1	1	3	....	5	3.1
Windows at one side only	....	4	....	....	4	2.5
Seats not close together	1	2	....	1	4	2.5
Accessibility	4	....	....	....	4	2.5
Entrance from rear and sides	....	....	....	2	2	1.2
Total	29	76	29	28	162	100.0

Definite provision should be made for illustrative material (Table XC). This includes blackboards, 28.2 per cent; facilities for a projection lantern, 28.2 per cent; chart racks, 23.1 per cent;

maps and globes, 12.0 per cent; ample laboratory supplies, 6.8 per cent; and conventional bulletin boards, 1.7 per cent.

Other physical conditions of importance are listed in Table XCI. Adequate ventilation, with 47 per cent, heads the list. Uniform temperature and freedom from outside distractions are mentioned in 16 per cent of the replies. Nine per cent mentioned acoustics.

TABLE XCII

Best Time of Day for Large Classes

Time	Preference					
	L	M	S	I	Total	Per Cent
Morning—indefinite	12	33	12	12	69	60.5
Early morning—before 10 a.m.	4	15	....	1	20	17.6
Late morning—after 10 a.m.	....	4	1	2	7	6.1
Early afternoon—before 3 p.m.	....	2	....	1	3	2.6
Late afternoon—after 3 p.m.	....	4	1	....	5	4.4
Immaterial	3	5	1	1	10	8.8
Total	19	63	15	17	114	100.0

Table XCII contains the replies concerning the best time of day for large classes. Eighty-four per cent consider the morning the best time, 18 per cent setting the time before 10:00 o'clock. Nine per cent believe it makes no difference, and the remainder favor the afternoon.

Managerial Procedures

It is not unlikely that the success or failure of large classes is due in part at least to the techniques of classroom management employed. It would seem that such factors as mere weight of numbers, increased size of room, and lack of personal contacts, must have an effect upon the instructor, causing him, consciously or unconsciously, to modify his procedures somewhat in an attempt to adapt them to the size of his group. Frequent testimony to that effect is offered by instructors.

If this be true, what are the usual modifications? The responses to this question are listed in Table XCIII. Only those definitely responding to this question are included in the tabulations. It is presumed that those not replying, of whom there were large num-

bers on some items, either feel that lack of extended experience with large classes rendered them incompetent to respond or that no modification was practiced.

TABLE XCIII

Distribution of Responses Concerning Necessity of Departing from or Modifying Customary Procedure with Small or Medium-Sized Classes to Adapt Them to Large Classes

Items	Total Number		Per Cent	
	Modification	No Change	Modification	No Change
Acquaintance with student	98	9	91.6	8.4
Amount of talking by teacher	92	17	84.5	15.5
Student participation	78	13	85.9	14.1
Attention to inferior student	75	16	82.5	17.5
Adapting work to individual student	66	19	77.7	22.3
Attention to superior student	64	23	73.6	26.4
Personal conferences with students	62	24	72.1	27.9
Tests and examination frequency	55	30	64.8	35.2
Teacher preparation	43	25	63.3	36.7
Use of illustrative material	41	30	57.8	42.2
Maintaining standards	32	38	45.8	54.2
Extent of ground covered in course	30	54	35.8	64.2
Reading papers	29	26	52.8	47.2
Class routine	27	30	47.4	52.6
Outside reading requirements	25	38	39.7	60.3
Assignments	22	47	31.9	68.1
Use of syllabus	22	34	39.2	60.8
Grading students	22	32	40.7	59.3
Maintaining discipline	20	62	24.3	75.7
Maintaining records	18	36	40.9	59.1
Handling make-up work	17	32	34.6	65.4
Content of course	16	54	22.8	77.2
Use of other devices	15	22	40.5	59.5
Use of textbooks	14	46	23.3	76.7
Tests and examinations (types)	14	39	60.9	39.1
Class organization	12	38	24.0	76.0
Total	1,009	834		

Acquaintance with Students

Ninety-eight of the 150 faculty members, or 92 per cent of those responding, found it necessary to depart from their usual

procedure in the matter of becoming acquainted with their students. A considerable number stated frankly that in their large classes they made no effort to become familiar with individual students. How much of an effect this lack of acquaintance plays in the success of instruction is exceedingly doubtful. It is probably less potent than is ordinarily believed, in spite of the fact that both students and faculty give it as one of the outstanding disadvantages of large classes. It is possible, however, to arrive at a suggestion of the truth by cross-checking replies to several questions. As reported in the previous chapter, students were asked to state who, in their opinion, was their most successful large-class instructor. Seventy-nine different faculty members were nominated. Of these, 25, or 32 per cent, were mentioned by two or more students. Eleven instructors mentioned at least twice are included in the present tabulation.

Bearing in mind the fact that the large classes of the above teachers are pointed out as successes by the students themselves, it may be profitable to learn the opinions of these selected instructors on the question of personal acquaintance. The most frequently mentioned teacher (26 times) says, "I gave up the idea of acquaintance with all." However, he is always available for consultation at the initiative of the student, even though he handles groups of more than 250 students. The next most frequently mentioned instructor (15 times) says, "It is harder to know the students, but I try to know and call them by name." Judging wholly from interviews with former students of his, few feel any handicap due to lack of acquaintance. A third instructor (13 mentions) says, "Rests wholly with assistants, except that any student is free to consult me."

Of the eleven reputedly most successful instructors, nine replied to this item of the questionnaire. Three said that student acquaintance is entirely lost, one believes that large classes have not made much difference with him, while four emphasize the point that, at the desire of the student, consultations are available.

Amount of Talking Done by Instructor

Returning to Table XCIII, we find the second most general modification necessitated by large classes is the amount of talking done by the teacher. The relative amount is greatly increased in

large classes. One instructor commented, "More lecturing takes place of quizzing. I am skeptical of the old dogma against that." Another wrote, "More talking in large classes, but I have compensated for this by some student reports by the more capable in class."

Student Participation

The third item most frequently modified to suit large classes was student participation. As stated in the previous discussion, more of the initiative commonly passes from the student to the instructor.

That student participation is relatively less in large classes is granted; that it must be less does not necessarily follow. In an address on the project method delivered during the February meeting of the Society of College Teachers of Education, held in Chicago, in 1922, Kilpatrick, who is probably the most outstanding teacher of large classes in America, said in part:

> I have myself used discussion groups, setting them to work at questions devised to arouse problems, and having the class discussion bring together and coordinate the ideas got together in study. As between this and lecturing or textbook assigning I am in no doubt. This is immensely superior even when the class is large. The amount of thinking done by the pupil is, I believe, far greater and the learning attitude far better.[1]

Kilpatrick, however, may be an exception. There is probably no single solution of the problem. The safest procedure would seem to be for each instructor to determine experimentally his own best technique.

Other Modifications

Contrary to popular belief, discipline is little more of a problem in large classes than in small. None of the eleven most frequently commended large-class instructors finds discipline a problem. An equally popular belief is that less ground can be covered in large classes. That this is not always, or even generally, true is indicated by the replies given. Fifty-four of the eighty-four instructors who responded to this question stated that there is no difference. Of the thirty who indicate a difference, five state that decidedly more ground can be covered in large classes.

[1] William H. Kilpatrick, *The Place of the Project Method in College Courses in Education* (Educational Monographs, Society of College Teachers of Education, No. 11, 1922), p. 56.

TABLE XCIV

Teaching Methods Found to Be Most Successful in Large Classes

Methods	Preference					
	L	M	S	I	Total	Per Cent
I. Use of Lecturers					(99)	(40.0)
a. Lecture	5	19	3	6	33	13.2
b. Lecture with discussion or quizzes	3	13	2	7	25	10.1
c. Lecture with demonstrations	3	12	1	4	20	8.1
d. Lecture with quiz sections	3	5	4	3	15	6.1
e. Lecture and recitation	....	4	....	1	5	2.0
f. Lecture with follow-up problems	1	....	....	....	1	.4
II. Use of Discussion					(9)	(3.7)
a. Case method, discussion finally made general	1	1	1	1	4	1.6
b. Discussion and demonstration of points in textbook	2	....	....	....	2	.8
c. Class debates	....	1	1	....	2	.8
d. Call on students for discussion	....	1	....	....	1	.4
III. Use of Questions					(9)	(3.7)
a. Answer questions asked by class	1	3	3	....	7	2.8
b. Begin with several review questions	1	....	....	....	1	.4
c. Frequent questions	....	1	....	....	1	.4
IV. Use of Individual and Socialized Procedures					(30)	(12.1)
a. Project, problems worked out by class	2	11	3	1	17	6.9
b. Socialized recitation	5	7	....	1	13	5.4
V. Use of Laboratory					(3)	(1.2)
a. Laboratory and recitation	....	....	1	....	1	.4
b. Laboratory assistant with definite group	....	1	....	....	1	.4
c. Experimental demonstrations	1	....	....	....	1	.4
VI. Sectioning	....	4	....	1	(5)	(2.1)

TABLE XCIV—*Continued*

TEACHING METHODS FOUND TO BE MOST SUCCESSFUL IN LARGE CLASSES

Methods	Preference					
	L	M	S	I	Total	Per Cent
VII. Measurement of Results........					(67)	(27.1)
a. Frequent quizzes	1	14	1	3	19	7.8
b. Weekly quizzes	3	5	2	....	10	4.0
c. Oral quizzes	1	8	....	....	9	3.7
d. Objective quizzes	2	2	2	1	7	2.8
e. Written quizzes	1	4	....	1	6	2.4
f. Daily quizzes	....	3	2	1	6	2.4
g. Term papers	....	1	3	....	4	1.6
h. Objective final examinations	1	....	1	....	2	.8
i. Essay type of examinations	....	1	1	....	2	.8
j. Final quizzes	1	....	....	....	1	.4
k. Essay final examinations..	....	1	....	....	1	.4
VIII. Instructional Aids					(25)	(10.1)
a. Textbook assignments........	3	7	0	2	12	4.9
b. Outside readings	....	4	....	....	4	1.6
c. Problems handed in............	2	....	....	....	2	.8
d. Definite assigned selected reading	....	....	....	2	2	.8
e. Mimeographed work sheet (outlines, bibliography, subject matter)	....	1	....	1	2	.8
f. Syllabus stating requirements of class..................	1	....	....	....	1	.4
g. Students given mimeographed outline of lecture	....	....	1	....	1	.4
h. Book of questions based on all outside readings..	....	....	1	....	1	.4
Total					247	100.0

Fifty-four instructors, or 77 per cent of those responding, say that there need be no essential modification of the content of the course in order to accommodate large classes. Assignments are modified to meet the facilities provided by the library and textbooks are used more freely. Outside reading references are subject to the same physical restriction. None of these, however, were felt to be inherent in large classes.

Teaching Procedures

What teaching methods are best adapted to large-student groups? The final answer can, of course, be determined only through careful experimentation. A logical first approach to the problem, however, is an analysis of the methods already found to be most successful by those who have had experience in handling large classes. The instructors were accordingly canvassed concerning successful teaching methods, with the results shown in Table XCIV. That the lecture, alone or in combination, should be most often advocated was not unexpected. The real surprise came from the testimony that so many other types of instruction are being successfully employed. Despite the decidedly expressed opinion of the majority of the responding faculty members as to the impossibility of giving individual attention in large classes, seventeen instructors reported the successful use of the most highly individualized form of instruction—the project or problem method. Thirteen, apparently unhampered by large numbers, are applying some form of socialized procedure. The responses indicate the relatively greater emphasis which must be placed upon careful and adequate measurement of results, the identical factor which the students singled out for major attention. The number and variety of instructional aids employed is also greater in large classes.

The types of instruction employed by the instructors who were especially named by the students is outlined in Table XCV. A comparison of this table with the preceding one reveals no significant difference in the methods used. The number tabulated is so small that no great stress can be placed upon the tendencies revealed, but they are at least highly suggestive of the possibility that the deciding factor in successful large-class instruction is the personality of the instructor and not the techniques employed.

Closely related to actual techniques of instruction are the methods of classroom organization and management. Table XCVI presents the replies to this phase of the inquiry. Students are ordinarily assigned definite seats and arranged alphabetically. Attendance is checked daily, generally by noting vacant chairs. The function of checking is performed most often by the instructor, sometimes through daily tests, occasionally by students, and rarely by an assistant. Promptness is insisted upon, often even to the

point of refusing admittance after the opening of the class hour. Discipline is maintained by attention to student moods. One instructor replied, "I keep tests ready, and when students show signs of restlessness, I spring a test on them." The typical instructor makes an effort to learn his students' names and finds that seating charts are of considerable aid. Much attention is paid to the prompt reporting of marks.

TABLE XCV

Teaching Procedures of the Eleven Selected Instructors

Procedures	Preference				
	L	M	S	I	Total
I. Use of Lectures					(9)
a. Lectures	1	2			3
b. Lecture with discussion	1	1			2
c. Lecture with occasional question	1				1
d. Lecture and discussion with small number of students		1			1
e. Lecture with demonstrations				1	1
f. Lecture with laboratory work			1		1
II. Use of Questions					(2)
a. Class questions to find out what should be discussed		1			1
b. Answers to questions by whole class				1	1
III. Use of Individual and Socialized Procedures					(2)
a. Use of problems				1	1
b. Conferences		1			1
IV. Use of Laboratory					(1)
a. Laboratory assistant to definite group		1			1
V. Measurements of Results					(4)
a. Oral quizzes in small groups		1			1
b. Short tests, essay and objective		1			1
c. Essay type final examination		1			1
d. Weekly written tests		1			1
VI. Instructional Aids					(2)
a. Text and assigned readings		1			1
b. Purposely making mistakes on blackboard to keep attention				1	1
Total					20

TABLE XCVI

METHODS OF CLASS ORGANIZATION AND CLASSROOM MANAGEMENT FOUND MOST SUCCESSFUL IN LARGE CLASSES

Methods	Preference					
	L	M	S	I	Total	Per Cent
I. Seating Arrangements					(40)	(43.5)
a. Definite seats	4	15	3	....	22	24.0
b. Alphabetically	4	9	2	....	15	16.3
c. By sexes	....	....	2	....	2	2.1
d. No definite seats	....	1	....	....	1	1.1
II. Checking Attendance					(28)	(30.4)
a. By observing vacant chairs	4	5	3	....	12	13.04
b. Taken daily	1	2	2	....	5	5.4
c. By daily tests	....	1	1	1	3	3.3
d. Not taken daily	1	1	....	....	2	2.1
e. Taken by students	....	1	1	....	2	2.1
f. Taken by assistants	1	....	....	....	1	1.1
g. Called by number	1	....	....	....	1	1.1
h. By short written reports of outside work	....	1	....	....	1	1.1
i. Yale method, seniors first, etc.	....	1	....	....	1	1.1
III. Classroom Management					(14)	(15.2)
a. Keep eyes on students	....	1	1	1	3	3.3
b. Doors locked on stroke of bell	....	1	1	....	2	2.1
c. Insist on promptness	1	....	1	....	2	2.1
d. Insist on orderliness	....	1	....	....	1	1.1
e. Extra credit given for prompt work	1	....	....	....	1	1.1
f. Eliminate all time-wasting details	....	1	....	....	1	1.1
g. Return papers before student arrival	....	1	....	....	1	1.1
h. Use blackboard, writing large	1	....	....	....	1	1.1
i. Walk around, encouraging students during tests	1	....	....	....	1	1.1
j. Show no favoritism	....	....	1	....	1	1.1

TABLE XCVI—*Continued*

METHODS OF CLASS ORGANIZATION AND CLASSROOM MANAGEMENT FOUND MOST SUCCESSFUL IN LARGE CLASSES

Methods	Preference					
	L	M	S	I	Total	Per Cent
IV. Student Contact					(6)	(6.5)
a. Learn students' names	....	2	1	....	3	3.3
b. Have definite office hours	1	....	....	....	1	1.1
c. Make appointments	1	....	....	....	1	1.1
d. Have two student contact officers	1	....	....	....	1	1.1
V. Reporting Marks					(4)	(4.4)
a. Scores posted by number	1	....	....	....	1	1.1
b. Scores read by number	....	....	....	1	1	1.1
c. Papers returned, arranged by seating chart	....	1	....	....	1	1.1
d. Always return work	....	....	1	....	1	1.1
Total					92	100.0

Advantages of Large Classes

The same question concerning advantages of large classes that was asked of the students was put to the faculty. The replies are listed in Table XCVII under the four major heads of Economy, Effect upon the Instructor, Effect upon Marking, and Effect upon the Student.

Of the 238 items listed, economy was mentioned as an advantage 93 times, or in 39.1 per cent of the replies. Economy in cost was the subdivision most frequently named, although economy of the instructor's time through obviating the necessity of repeatedly presenting the same material to successive groups and also less waste of student time, were both prominently mentioned.

Effect upon the instructor was given second place, 77 replies, or 32 per cent, citing this advantage. Chief among the reasons were the stimulation of the instructor to higher levels of achievement and the permitting of fewer but better instructors. The fact that large classes usually assured a more systematic presentation and that they permitted higher standards, was also given a place.

Those who listed the effects upon marking did so because they

believed that large classes permit more accurate relative grading and because they tend to result in more objective evaluation of students' work. This belief is supported by the prominence given to measurement of results in the previous discussion of suitable managerial procedures.

Approximately one-fourth of the advantages listed had to do with the student. The three leading items were the fostering of

TABLE XCVII

Advantages of Large Classes, According to Faculty

Items	Total	Per Cent
I. Economy	(93)	(39.10)
a. Economy in cost	50	21.00
b. Economy of teacher's time in presenting material	25	10.50
c. Less waste of student time	10	4.20
d. Frees instructor for research	5	2.10
e. Exploration of wider field of material	3	1.26
II. Instructor	(77)	(32.35)
a. Stimulates instructor	24	10.08
b. Encourages more careful preparation	16	6.72
c. Permits fewer but better type of teacher	14	5.88
d. More systematic presentation	8	3.36
e. Permits higher standards	7	2.94
f. Dignifies subject	4	1.68
g. Less wearing on instructor	2	.85
h. More efficient standardization	2	.85
III. Marking	(11)	(4.60)
a. Permits more accurate relative grading	9	3.78
b. Brings more objective evaluation of student	2	.85
IV. Student	(57)	(24.00)
a. Fosters student initiative	12	5.04
b. Social stimulation (*esprit de corps*)	12	5.04
c. Student competition is keener	11	4.62
d. Stimulation of student by lectures	6	2.52
e. Greater interest on part of students	6	2.52
f. Greater variety of student reactions	4	1.68
g. Permits student contact with great teachers	3	1.26
h. Assistants get good preparation for teaching	2	.85
i. More thorough discussion of open questions	1	.42
Total	238	100.00

student initiative, the opportunity for social stimulation, and the encouragement of student competition.

A few faculty members took advantage of the opportunity to indicate the advantages that they feel to be inherent in large classes (Table XCVIII). The replies are quite scattered. Economy of cost and economy of the teacher's time in presenting material are the leading items checked. Next in frequency are the stimulation of the instructor and the possibility of fewer but better teachers.

TABLE XCVIII

ADVANTAGES WHICH CAN ACCRUE ONLY IN LARGE CLASSES

Items	Total	Per Cent
I. Economy	(32)	(53.33)
a. Economy in cost	18	30.00
b. Economy of teacher's time in presenting material	9	15.0
c. Frees instructor for research	3	5.0
d. Less waste of student time	1	1.7
e. Exploration of wider field of material	1	1.7
II. Instructor	(16)	(26.67)
a. Permits fewer but better type of teacher	4	6.6
b. Stimulates instructor	4	6.6
c. More careful preparation of teacher	3	5.0
d. More systematic presentation	2	3.3
e. Permits higher standards	1	1.7
f. Less wearing on instructor	1	1.7
g. More efficient standardization	1	1.7
III. Marking	(2)	(3.33)
a. Permits more accurate relative grading	2	3.3
IV. Students	(10)	(16.67)
a. Fosters student initiative	3	5.0
b. Student competition is keener	3	5.0
c. Greater variety of student reactions	2	3.3
d. Permits student contact with great teachers	1	1.7
e. Social stimulation (*esprit de corps*)	1	1.7
Total	60	100.0

It is worth noting how closely the students and faculty members agree as to the advantages of large classes and the relative importance of these advantages. Table XCIX is offered as evidence in point. Of the ten items considered of most importance, seven are

common to both lists. The closest agreement is on economy in cost, although the two groups are in fairly close agreement as to provision for fewer but better teachers and the fostering of student initiative.

TABLE XCIX

THE TEN ADVANTAGES OF LARGE CLASSES WHICH WERE LISTED MOST FREQUENTLY BY STUDENTS AND BY FACULTY MEMBERS

RANK	ADVANTAGES	PER CENT OF REPLIES
	Student Replies	
1	*Economy of cost	13.3
2	Greater variety of student reactions	11.1
3	*Permits fewer but better type of teacher	10.8
4	*Fosters student initiative	8.9
5	*Economy of faculty presentation	7.9
6	*Permits more accurate relative grading	7.0
7	*Student competition is keener	6.2
8	Gives broader contacts	5.4
9	*Social stimulation	4.1
10	More objective evaluation of student	3.8
	Faculty Replies	
1	*Economy of cost	21.0
2	*Economy of faculty presentation	10.5
3	Stimulation of instructor	10.1
4	Encourages more careful preparation	6.7
5	*Permits fewer but better type of teacher	5.9
6	*Fosters student initiative	5.0
7	*Social stimulation	5.0
8	*Student competition is keener	4.6
9	Less waste of student time in aimless discussion	4.2
10	*Permits more accurate relative grading	3.8

* The starred items are common to both lists.

DISADVANTAGES OF LARGE CLASSES

As with the students, the faculty members were asked to list what they considered the disadvantages of large classes. The replies, of which 370 were offered, are distributed over the four major heads, Measurement of Results (39.7 per cent), Effect upon Students (33.0 per cent), Effect upon Instruction (20.8 per cent) and Physical Facilities (6.5 per cent). The detailed disadvantages are set forth in Table C. The physical factors appear to be of

TABLE C

DISADVANTAGES OF LARGE CLASSES, ACCORDING TO FACULTY

ITEMS	TOTAL	PER CENT
I. Physical Facilities	(24)	(6.5)
a. Difficulty of seeing	6	1.6
b. Difficulty of hearing	5	1.4
c. Emphasize mechanics of class management	5	1.4
d. Lack of satisfactory physical facilities	4	1.1
e. Lack of adequate library facilities	3	.8
f. Expense of duplicating expensive equipment	1	.3
II. Effect on Instruction	(77)	(20.8)
a. Tends to stereotyped instruction	16	4.3
b. Less class discussion possible	14	3.8
c. Increases distractions	10	2.7
d. Unable to use conferences	7	1.9
e. Leads to less student attention	7	1.9
f. Forces lecture method	6	1.6
g. Difficult to demonstrate clearly	5	1.4
h. Poor laboratory work	4	1.1
i. Cannot provide classroom drill	3	.8
j. No oral drill in foreign language classes	3	.8
k. Discipline more difficult	2	.5
III. Measurement of Results	(147)	(39.7)
a. Lack of personal acquaintance by teacher	56	15.1
b. Difficult to check student progress	16	4.3
c. Inability of diagnosing individual student difficulties	13	3.5
d. Requires more effort on the part of instructor	10	2.7
e. Easier for shirkers to get by	10	2.7
f. Instructor cannot stimulate thought	9	2.4
g. Difficult to quiz students	9	2.4
h. Less careful reading of papers	7	1.9
i. Better opportunity for students to copy	5	1.4
j. Reporting marks to students more difficult	4	1.1
k. Fosters misunderstandings (cannot clarify points)	3	.8
l. Forces entire use of objective tests	2	.5
m. More class time used in testing	1	.3
n. Difficulty of securing competent assistants	1	.3
o. Leads to more failures	1	.3

TABLE C—*Continued*

DISADVANTAGES OF LARGE CLASSES, ACCORDING TO FACULTY

ITEMS	TOTAL	PER CENT
IV. Effect on Students	(122)	(33.0)
a. Less individual attention	53	14.3
b. Less opportunity for student participation	20	5.4
c. Harder on slow student	15	4.1
d. Best students are held back	12	3.2
e. Less student interest	12	3.2
f. Less spontaneity during class hour	4	1.1
g. Bright students come to front more easily	3	.8
h. Less class spirit	2	.5
i. Submerges timid student	1	.3
Total	370	100.0

little consequence, the emphasis being almost identical with that given in the student replies. Under effect upon instruction are found eleven sub-heads with chief emphasis laid upon three—the tendency to stereotyped instruction, the lessening of opportunity for class discussion, and the increase in distractions. Faculty members and students alike lay greatest stress on the items concerned with the measurement of results. Of the 15 subdivisions, 7 are listed by 9 or more faculty members. The chief objection is the lack of personal acquaintance by the teacher. Next appears the difficulty of checking student progress, followed closely by inability to diagnose individual student difficulties.

The major complaint concerning students' difficulties is the lessening of individual attention. Second comes the decreased opportunity for student participation, and third is the fact that large classes are harder on the slow student.

As in the case of the advantages, the instructors were asked to stipulate those disadvantages which they believe are inherent in large classes. Seventy-four replies covering twenty-five separate items were received and are listed in Table CI. A wide diversity of opinion is apparent, only seven separate items being checked by three or more instructors. These are lack of personal acquaintance by the teacher, less individual attention, harder on the slow student, less opportunity for student participation, inability to diagnose

individual student difficulties, less class discussion possible, and best students are held back. It is perhaps true that most of these objections are present in large classes as now constituted and conducted; but it is doubtful that they are inherent.

To emphasize the almost identical agreement between students and instructors concerning large-class disadvantages as listed in the major categories, Table CII is furnished. The chief fields in

TABLE CI

Disadvantages Inherent in Large Classes, According to Faculty

Items	Total	Per Cent
I. Physical Facilities	(4)	(5.4)
a. Difficulty of seeing	2	2.7
b. Difficulty of hearing	1	1.4
c. Lack of adequate library facilities	1	1.4
II. Effect on Instruction	(10)	(13.5)
a. Less class discussion possible	3	4.0
b. Tends to stereotyped instruction	2	2.7
c. Unable to use conferences	2	2.7
d. Difficult to demonstrate clearly	1	1.4
e. Increases distractions	1	1.4
f. Discipline more difficult	1	1.4
III. Measurement of Results	(31)	(41.9)
a. Lack of personal acquaintance by teacher	13	17.4
b. Inability of diagnosing individual student difficulties	5	6.7
c. Instructor cannot stimulate thought	2	2.7
d. Difficult to check student progress	2	2.7
e. Difficult to quiz students	2	2.7
f. Easier for shirkers to get by	2	2.7
g. Less careful reading of papers	2	2.7
h. Requires more effort on part of students	1	1.4
i. Better opportunity for students to copy	1	1.4
j. Reporting marks to students more difficult	1	1.4
IV. Effect on Student	(29)	(39.2)
a. Less individual attention	10	13.5
b. Harder on slow student	6	8.1
c. Less opportunity for student participation	6	8.1
d. Best students hold back	3	4.0
e. Less spontaneity during class hour	2	2.7
f. Less student interest	2	2.7
Total	74	100.0

TABLE CII

COMPARISON OF STUDENT AND FACULTY OPINION OF THE DISADVANTAGES OF LARGE CLASSES

Major Groups of Disadvantages	Percentage Listing by	
	Students	Faculty
I. Physical facilities	6.8	6.5
II. Effect on instruction	21.2	20.8
III. Measurement of results	39.5	39.7
IV. Effect on students	32.5	33.0
Total	100.0	100.0

TABLE CIII

THE TEN DISADVANTAGES OF LARGE CLASSES WHICH WERE LISTED MOST FREQUENTLY BY STUDENTS AND BY FACULTY MEMBERS

Rank	Disadvantages	Per Cent of Replies
	Student Replies	
1	*Lack of personal acquaintance by the teacher	20.4
2	*Less class discussion possible	8.1
3	Submerges timid student	7.2
4	*Less student interest	6.0
5	*Less individual attention	5.7
6	Easier for shirker to get by	5.5
7	Fosters misunderstandings	3.8
8	*Difficulty of checking student progress	3.0
9	*Less opportunity for student participation	3.0
11	Difficulty of hearing	2.8
11	*Harder on slow student	2.8
11	Less spontaneity during class hour	2.8
	Faculty Replies	
1	*Lack of personal acquaintance	15.1
2	*Less individual attention	14.3
3	*Less opportunity for student participation	5.4
4	*Difficulty of checking student progress	4.3
5	Tends to stereotyped instruction	4.3
6	*Harder on slow student	4.1
7	*Less class discussion possible	3.8
8	Inability of diagnosing individual difficulties	3.5
9	Best students are held back	3.2
10	*Less student interest	3.2

* The starred items are common to both lists.

which objections are found are measurement of results and effect upon students. But Table CIII shows that the agreement extends beyond the major divisions. The ten ranking items mentioned by each group are here displayed.[2] Of these leading disadvantages it will be seen that seven are common to both groups. This is consistent with the findings concerning large-class advantages. The very fact that there is such close agreement as to what constitutes the shortcomings of large groups magnifies the importance of these evident disadvantages. Any attempt at improvement of large-class instruction must, therefore, be definitely pointed toward first overcoming these leading obstacles which popular opinion so readily recognizes.

Aims

What educational aims are large classes best adapted to realize? The judgments of the faculty on this point may be seen in Table CIV. Quantity or mass education is the reply most frequently made. Nine persons stated that, in their opinion, large classes are

TABLE CIV

Educational Aims Large Classes Are Best Adapted to Realize

Educational Aims	Preference					
	L	M	S	I	Total	Per Cent
Quantity or mass education	2	5	5	4	16	23.3
General orientation	1	5	3	2	11	16.0
None	....	3	4	2	9	13.0
Socialization	....	5	1	2	8	11.6
Information	....	5	....	1	6	8.7
Gives teacher training in adapting material	1	2	2	....	5	7.2
Independence and higher standards	4	....	....	....	4	5.8
Standardization of instruction	....	3	....	....	3	4.4
Initiative developed	1	1	....	....	2	2.9
Teaching of subject matter	....	....	1	1	2	2.9
Theoretic outcomes	....	1	....	....	1	1.4
Information for cultural and technical purposes	....	....	....	1	1	1.4
Organization	....	....	....	1	1	1.4
Total	9	30	16	14	69	100.0

[2] Twelve items are listed for the students because the three last subdivisions, which in the table are ranked 11, were each mentioned an equal number of times.

not best adapted to the realization of any educational aims. One instructor replied, "Everything good which can be done in a large class can be accomplished much better in a small class." Such an unsupported statement, however sincere, is exceedingly difficult to justify in the face of the experimental evidence to be presented in the next chapter.

TABLE CV

Educational Aims Large Classes Are Least Adapted to Realize

Educational Aims	Preference					
	L	M	S	I	Total	Per Cent
Provision for individual	2	12	3	4	21	28.4
Personal suggestion by teacher, inspiration, ideals	3	5	4	3	15	20.3
Independent thinking and reasoning	....	3	5	4	12	16.3
Thoroughness	....	6	....	....	6	8.1
General participation in discussion	1	1	1	1	4	5.4
Appreciation of subject	....	3	1	....	4	5.4
Fostering weak and lazy students	3	1	....	....	4	5.4
Intensive study tending to research	....	2	....	1	3	4.1
Fellowship between teacher and pupil	....	2	....	....	2	2.7
Accurate mastery of spoken language in foreign-language classes	....	1	....	....	1	1.3
Vocational	....	1	....	....	1	1.3
Information	....	....	1	....	1	1.3
Total	9	37	15	13	74	100.0

TABLE CVI

Best Class Size for Developing Student Initiative

Class Size	Preference					
	L	M	S	I	Total	Per Cent
Large	8	7	1	3	19	18.1
Medium	1	18	....	2	21	20.0
Small	2	36	16	7	61	58.1
Immaterial	1	....	....	3	4	3.8
Total	12	61	17	15	105	100.0

TABLE CVII

Type of Student Handicapped by Large Class

Type of Student	Preference					
	L	M	S	I	Total	Per Cent
Inferior	10	33	11	10	64	35.4
Timid—reticent	2	32	5	8	47	25.9
Superior	2	22	9	3	36	19.9
Shirker	....	16	2	1	19	10.5
Average	....	11	2	2	15	8.3
Total	14	114	29	24	181	100.0

TABLE CVIII

Type of Student Favored by Large Class

Type of Student	Preference					
	L	M	S	I	Total	Per Cent
Superior	7	16	3	9	35	40.7
Average	3	9	5	5	22	25.6
Shirker	1	10	6	1	18	20.9
Inferior	....	4	2	2	8	9.3
Timid—shy	....	1	1	1	3	3.5
Total	11	40	17	18	86	100.0

Referring again to Table CIV, we find, in order of rank, "general orientation," "socialization," "information," "gives the teacher training in adapting materials," and "independence and higher standards," each of which is listed three or more times.

The educational aims for which large classes are thought to be least adapted are stated in Table CV. The most significant items are provision for the individual, personal suggestion by the teacher, inspiration, ideals, and independent thinking and reasoning.

It is illuminating to note the disagreement expressed in Table CVI as to the best class size for encouraging student initiative. Two-thirds of the instructors who favor large classes believe that they are best suited to developing initiative. All other groups believe that small classes perform this function best.

What type of student is handicapped by large classes? In Table CVII, 35 per cent name the inferior student, 26 per cent the timid or reticent, 20 per cent the superior, 11 per cent the shirker, and 8 per cent the average student.

What type is favored by large classes? The superior student heads the list, followed in order by the average, the shirker, the inferior, and the meek. In both Table CVII and CVIII the replies run the entire gamut. The inferior and the superior student appear in both lists.

Ninety-one instructors hazarded a guess as to the effect of class size upon student failures (Table CIX). More than half believe that there is no direct relationship, while 41 per cent opined that large classes increase the proportion of failures. The latter is in accord with student opinion but in direct contradiction to the findings set forth in Chapter IV.

More than three-fourths of the instructors believe that homogeneous grouping will increase the likelihood of large-class success (Table CX). Eleven per cent think that such grouping would be

TABLE CIX

Effect of Large Classes on Number of Failures

Effect	Preference					
	L	M	S	I	Total	Per Cent
No change	14	22	3	10	49	53.8
More	....	28	6	3	37	40.7
Less	....	3	1	1	5	5.5
Total	14	53	10	14	91	100.0

TABLE CX

Effect of Homogeneous Grouping upon Success of Large Classes

Effect	Preference					
	L	M	S	I	Total	Per Cent
Improve	5	29	8	7	49	77.8
No change	2	3	2	....	7	11.1
Unfortunate	....	6	....	1	7	11.1
Total	7	38	10	8	63	100.0

TABLE CXI

Basis for Grouping Students

Basis	Preference					
	L	M	S	I	Total	Per Cent
Ability	7	21	7	5	40	44.4
Intelligence	....	12	7	5	24	26.7
Marks in previous subjects	3	8	4	1	16	17.8
Subject-matter tests	....	3	....	2	5	5.6
Superior—average—inferior	1	2	....	....	3	3.3
Combination	....	2	....	....	2	2.2
Total	11	48	17	13	90	100.0

TABLE CXII

Relation of Class Size to Physical Strain on Instructor

Physical Strain	Preference					
	L	M	S	I	Total	Per Cent
Greater	7	45	14	10	76	66.7
None	6	19	3	6	34	29.8
Less	2	2	....	....	4	3.5
Total	15	66	17	16	114	100.0

TABLE CXIII

Relation of Class Size to Emotional Strain on Instructor

Emotional Strain	Preference					
	L	M	S	I	Total	Per Cent
Greater	9	33	9	9	66	55.1
None	2	22	6	6	36	33.0
Less	5	5	1	2	13	11.9
Total	16	60	16	17	109	100.0

disastrous. As a basis for homogeneous grouping, ability is the criterion most often suggested (Table CXI). Others would accept intelligence, former marks, subject-matter tests, or a combination. Three instructors suggested a threefold differentiation into superior, average, and inferior students, a plan somewhat similar to that now being followed in the Department of Mathematics.

TABLE CXIV

CHOICE OF INSTRUCTORS AS TO TEACHING PLAN, WEEKLY STUDENT-HOUR LOAD REMAINING CONSTANT

Teaching Plan	Preference					
	L	M	S	I	Total	Per Cent
Three large classes	16	22	6	10	54	41.5
Two large and two small classes	2	22	4	5	33	25.4
Six small classes	1	11	8	1	21	16.2
Qualified	....	14	4	3	21	16.2
Immaterial	....	....	....	1	1	.7
Total	19	69	22	20	130	100.0

Two-thirds of the faculty members express the belief that large classes increase the physical strain on the teacher (Table CXII). As indicated in Table CXIII, sixty-six instructors believe that large classes also increase emotional tension. Thirteen, on the other hand, think that large classes decrease the emotional strain.

As a rule, university instructors are zealous in guarding their leisure time that it may be devoted to study or research. One of the deterrents to the widespread adoption of larger classes is undoubtedly the fear that teaching load, expressed in student credit-hours, will be increased with no compensation to the instructor, since the administration recognizes only load as expressed in weekly credit-hours of teaching. Table CXIV shows that, with the same student credit-hour load, 41 per cent of the faculty members who replied prefer three large classes to any other arrangement, while but 16 per cent favor six small classes. It is also probably true that if adequate clerical assistance were provided, most faculty members would prefer to carry a somewhat heavier total load in student credit-hours with fewer but larger classes, rather than a lighter load but with an increased number of class meetings.

Miscellaneous Testimony

In addition to the testimony elicited by the questionnaire, the subcommittee has during its three-year investigation received through conference discussions, personal conversations, and other random faculty contacts, numerous suggestions and points of view that have, by clarifying the problem and focusing attention upon

the critical issues, guided the subcommittee in devising, or in helping instructors to devise, valid experimental techniques. These many suggestions, though speculative, have incidentally revealed a surprisingly wide interest among the members of the faculty and a general recognition of the importance and insistence of the problem of class size.

One of the most analytical of these random, empirical contributions was made by Professor F. W. Springer at a meeting of the Society for the Promotion of Engineering Education. His discussion is quoted here to show how ramified the problem of class size is and how dependent the solution of it is upon departmental conditions and policies.

Optimum-Sized Classes and Laboratory Sections in Electrical Engineering

Franklin W. Springer

After experimenting for more than fifteen years with classes up to 85 and laboratory sections as large as 25, I have reached the following conclusions:

Satisfactory educational results should be obtained by experienced instructors, using proper methods, in case of electrical-engineering sophomores, juniors, and seniors, in classes up to something greater than 100 per section, depending upon the classroom conditions and arrangements (ventilation, acoustics, temperature, illumination, vision, tablet chair, comfort, and humidity).

In the regular electrical laboratory work experience indicates a maximum of ten to twelve per section for sophomores, fourteen to eighteen for juniors, and sixteen to twenty-four for seniors. In the case of each course the smaller number applies to the first quarter of the year's work, particularly to the first half of the first quarter. It is found that in the latter part of the year students have become more self-directive in each of their courses; and this is true not only from quarter to quarter of one year, but from year to year. A fair average would be ten sophomores, sixteen juniors, and twenty seniors per laboratory section. These numbers should not be exceeded, particularly in the beginning quarter of a year course.

These, however, are not all the factors; there are many others, possibly controlling ones, as follows:

The larger percentage of engineering educators seem to favor small class and laboratory sections for various reasons. It is not at present a popular thing to advocate or practice handling large classes in engineering.

There is much other work to be done in a department besides the teaching itself. Large sections tend to reduce the numerical strength of a department and this reduces its influence in so far as numbers count.

The range of specialties, as affecting research and public service, is also influenced, generally reduced.

Large sections with fewer instructors will not be likely to have a good effect upon research work unless the discrepancy is deliberately offset in some other way.

Credit in work is generally thought to be rated in terms of credit-hours per week, irrespective of the size of classes. It is a heavier load to carry large classes than small ones, and instructors do not wish to be penalized or to have their respective departments placed at a relative disadvantage in obtaining needed help.

Program difficulties are likely to arise in the upper years owing to the likelihood of some of the students being cut out of certain electives by having only one class section, as in electrical engineering. No doubt these difficulties could be minimized by the Program Committee.

A general policy of large classes would immediately require rearranged and redesigned classrooms and laboratories in many cases (a large order).

There are advantages and disadvantages in large and small classes. The large class stimulates the instructor more than a small one does. Just as no one would care to see a theatrical performance or hear a sermon alone, there is a certain amount of driving force and stimulation felt by the individuals of a large class as a result of numbers.

No advocate of large classes would be likely to contend that a teacher could do better work in general with 100 per section than with only 25 per section, disregarding cost; but most teachers would admit that, for the same cost, better educational results would be obtained by an experienced teacher having 100 students in a class section, than by four inexperienced teachers with 25 per section.

Until the problem is solved to the point where the administration can deliberately support and encourage large classes, it would not seem to be advisable for a particular department to attempt it on a complete scale.

Consider one experienced teacher receiving $6,000, handling a section of 100 students, assisted by a part-time teaching fellow receiving $800 for correcting papers, in comparison with the same 100 students taught in sections of 25 by four instructors receiving $1,700 each. Note further that if good instructors could be obtained for $1,700, they would be immediate candidates for substantial increases.

In the case of addresses, lectures, demonstrations, written recitations, and examinations, the limit in number of students is probably much higher than many engineering teachers suspect. At a recent convocation the President spoke to an audience of several thousand. In order that all might hear perfectly, a public-address system for sound amplification was used. Clearly in such a case, being able to see the speaker would set the limit to the maximum number. No one would believe that such an

address or lecture would be more effective if delivered in sections of 25.

It is just possible that engineering teachers, habituated to small classes and small laboratory sections, owing to the natural limitations resulting from small registration and divisions into specialties, have failed to note some of the advantages of large classes such as may be found in other colleges. No doubt there are courses and parts of courses in engineering which could be handled with satisfactory educational results in large sections.

Undoubtedly, each course will have to be studied by itself and the optimum-sized classes and laboratory sections decided upon by the needs of each case. The range in size may be 1 to 100,000. Unseen audiences, by radio, may be millions in number. Shop-work, ordinary engineering laboratory and research work, oral foreign-language practice, music, and other supervised practice sections should, of course, be limited to a number such that proper individual attention may be given to students; but it would seem that no such limitations need apply to lectures, written recitations, examinations, or demonstrations.

Summary of Faculty Testimony

One hundred and fifty University of Minnesota instructors, representing eleven collegiate divisions and fifty-six separate departments, are included in a tabulation of questionnaire responses concerning experience with classes of different sizes. All teaching ranks are represented in the replies.

Of the 150 instructors, 21 prefer to teach large classes, 8 prefer to teach medium-sized sections, 23 prefer small groups, while 17 have no preference.

The medium optimum sizes of class voted by instructors for the junior-college, senior-college, and graduate lecture classes were 75, 40, and 20, respectively; for recitation classes, 25, 20, and 15; and for laboratory classes, 20, 15, and 10. Faculty limits were much more conservative than those indicated by students.

Eleven per cent have taught only one large class; 51 per cent have taught 2 to 10; and 38 per cent, 11 or more. The median number of large classes taught is 9.

The typical largest class taught was a well-established lecture course, offered in 1926, with a student enrollment of 63, predominantly sophomores. It was organized because of heavy student election combined with a shortage of teachers and considerations of economy.

Final marks are based mainly upon gross accomplishment, al-

though initiative and originality, improvement, and industry and application are also considered.

Gross accomplishment is measured chiefly by means of frequent short quizzes supplemented by both objective and essay type of mid-quarter and final examinations.

Most large-class instructors are assisted by a graduate student whose duties are chiefly concerned with student marks.

Physical conditions are considered to be of some importance in large-class instruction. Under ideal classroom conditions, the seats are provided with tablet arms and are rigidly arranged in a semicircle. The floor is pitched and a raised platform is provided for the instructor. Indirect artificial lighting is preferred and the room is adequately ventilated and heated. Ample provision is made for illustrative material.

Ideally the large class is held at an early morning hour.

Considerable modification from small- or medium-sized class procedure is believed to be necessary with large groups. Among the chief changes are less acquaintance with the student, more talking by the teacher, less student participation, and less attention to the inferior students.

The chief advantages of large classes are voted to be economy in cost, economy of faculty presentation of material, the stimulation of the instructor, the incentive to more careful preparation on the part of the teacher, and the fact that fewer but better teachers may be provided.

The chief disadvantages are thought to be the lack of personal acquaintance with the students, reduction in individual attention, the lessening of opportunity for student participation, the difficulty of measuring student progress, and the tendency to stereotyped instruction.

Large classes are said to be best adapted to quantity or mass education and for general orientation. They are felt to be least adapted to provision for the individual, personal suggestion by the teacher, and independent thinking and reasoning on the part of students.

Large classes are believed to handicap inferior students and to favor superior students. They are thought not to affect the pro-

portion of student failures but would be improved if homogeneous grouping on the basis of ability were followed.

They increase the physical and emotional strain on the instructor in his own estimation; yet if the student-credit-hour teaching load were left unchanged most instructors would prefer to teach three large classes to six small ones or two large and two small ones.

The general problem of class size involves many issues and considerations which assume somewhat different guises and proportions in each department.

CHAPTER VII

EXPERIMENTAL EVIDENCE

Inception of the Study

The present series of experimental studies was undertaken shortly after Edmonson and Mulder reported the results of their brief experiment at the University of Michigan.[1] A comprehensive experimental investigation of the problem of class size at the University of Minnesota was first proposed by Dean J. B. Johnston of the College of Science, Literature, and the Arts. It was further stimulated by the findings of Professor W. S. Foster of the Department of Psychology, who had long been interested in the general problem. Although he had a marked preference for small groups, Professor Foster, characterized by the open-mindedness of the true scientist, had, in the fall quarter of 1924, already launched two carefully controlled experiments on the measurable effects of class size. One unit was conducted by Professor Foster himself, the other by Miss Edna Heidbreder of the same department. The findings of these studies are reported below.

Method of Attack

The study of class size at the University of Michigan, although suggestive, employed a limited experimental technique. Perhaps the chief weakness was the lack of adequate control. In the matching of groups the only quantitative measurements considered were those of intelligence, and no evidence was presented on man-to-man matching. Now, correlations between intelligence and marks in college ordinarily range from .35 to .45. Since they are no higher, it is probably unsafe in experiments of this kind to neglect the other factors that play a more or less decided part in student achievement. Among these other factors may be mentioned persistence, initiative, proper habits of study, outside interests, general physical health, and extended experience. The effects of few of these can be directly determined, but their combined influence is indirectly expressed in a cumulative record of school marks.

[1] J. B. Edmonson and F. J. Mulder, "Size of Class as a Factor in University Instruction," *Journal of Educational Research*, 9:1-12 (January, 1924). For a review of the experiment, see Chapter II.

A Technique of Experimentation

Early in the course of the present investigation the subcommittee on class size drew up a suggestive technique for experimentation. Part I, setting forth essential considerations, is reproduced below. The complete technique may be found in the Appendix.

A Suggestive Technique for Experimentation on the Relation of Class Size to Teaching Efficiency

A. COURSE

1. There should be at least two sections in the same course, a large and a small.
2. The course should be a well-established one, not a new one undergoing significant modifications.
3. Both sections should cover the same content within the outline of the course.

B. STUDENTS

1. The enrollment must be large enough to permit of careful pairing of students on as many as possible of the following bases. (That is, each student in the smaller section should be matched on as many bases as possible with a student in the larger section. If feasible, the matching should be done before the experiment begins.)
    a. *Intelligence.* This is to be measured by one or more standard mental tests.
    b. *Scholarship.* To be based upon the average honor points or the average grade in previous courses, preferably at the University of Minnesota, over at least two quarters of work. For freshman students high-school records must suffice.
    c. *Sex.* There should be approximately the same ratio of men and women in both sections.
    d. *Class.* Students should be matched as nearly as possible as to college class, such as freshmen, sophomores, etc. The more homogeneous the group is on this basis, the better.

C. INSTRUCTOR

1. The same instructor should teach both large and small sections.
2. The instructor must be prompted by an attitude of scientific inquiry toward the problem.
3. If any deviations in methods of instruction or classroom management are made between sections, they should be faithfully recorded.
4. To counteract any effect which practice in teaching the particular lesson might have, the large section should precede the small during one quarter and the order reversed the next quarter. If the course extends over only one quarter, one section should be kept

a day or two ahead of the other during the first half of the course, with the order reversed during the remainder of the quarter.

D. MEASUREMENT OF ACHIEVEMENT

1. *Examinations.* Examinations should be given to both sections, as nearly as feasible, at the same time. Frequent short quizzes are recommended in order to secure adequate bases for measurement. The more definite the questions are, the greater reduction there will be in the element of subjectivity. All reading of test papers should be done by the same person in a uniform manner and without knowledge of the identity of the writer.
2. *Marks.* The procedure by which the instructor arrives at the final rating should be recorded in detail. This should include such matters as the weight given to daily work, weekly quizzes, mid-quarter examination, final examination, notebooks, etc.

E. OTHER ESSENTIAL CONSIDERATIONS

In the experiments hereinafter reported an attempt was made to meet, so far as possible, these essential standards. The exigencies of a particular situation sometimes precluded the possibility of rigid adherence at all times, so some deviation in minor matters was permitted in a portion of the experiments.

Definition of Criteria

The first pairing factor (P.F.1) was usually some measure of intelligence. These measures are variously expressed as absolute scores or as percentile ranks. The scores are taken from either the Miller A Mental Ability Test, Form B of the same test, or the University of Minnesota Freshman Test. Percentile ranks, whenever used in experiments in the Liberal Arts College, should be interpreted as the percentile rank of the entering freshman students. In experiments in the College of Education such ranks refer to relative position of predominantly junior students, who are examined upon entrance to the College of Education.

Some measure of scholarship was ordinarily accepted as the second pairing factor (P.F.2). Scholarship is variously taken. Sometimes it is measured by honor points, as usually determined at the University of Minnesota (A=3, B=2, C=1, D=0, and F=minus 1). Upon other occasions it is expressed in mark points, which were secured in three different ways. The first was by assigning the values A—1, B—2, C—3, D—4, E—5, and F—6. The second was the inverted order of A—5, B—4, C—3, D—2,

E—1, and F—0. The third was similar to the second except that F was substituted for E. This was done so that the practice of giving large numbers of E's would not have too much influence.

There were two reasons for accepting alternative measures. The first was inaccessibility of reports. In some cases it was exceedingly difficult to find complete records. They were therefore copied as they were found, to avoid duplicate labor. The second and more important reason was that it was believed that varying the procedure would prevent a constant error in favor of either the superior or inferior students due to the uniform scheme of weighting used. It was fully realized that the disadvantage of this policy is, of course, the direct loss in case of comparison between experiments; but the advantage was felt to outweigh this limitation. The all-important thing is to keep the procedure uniform in both parts of a given experiment, and this was done. The same weights were always assigned to all marks of students in both the large and the small sections in the same experiment. In studying intercomparisons between groups in different experimental units, therefore, the possibility that a different weighting was used must be kept in mind lest erroneous conclusions be drawn.

Student achievement was always taken as the final criterion (F.C.). In determining student achievement in a course, the most common measure taken was the total score on an objective final examination. This was used so that the personal judgment of either the instructor or the experimenter could have no effect upon the objectivity of the measure.

The objection might be raised that it is unfair to measure student achievement wholly in terms of the results of a single examination. In answer it may be said that in some of the experiments the final criterion was an average of several short quizzes, an objective mid-quarter examination, and an objective final examination. It will appear later that the general experimental results were the same under both procedures.

That the essay type of examination is better suited to measuring certain outcomes is also frequently maintained. To allow this argument a fair hearing, in several experimental units the instructor's final marks, based largely upon the essay type of examination, were accepted as final criteria.

Exceptional circumstances are referred to in connection with the discussion of each of the groups of experiments.

Limits of "Large" and "Small" Classes

One of the first questions faced in such an investigation is concerned with class-size limits. What may be considered a large class and what a small? Obviously no one answer could satisfy all departments, all types of courses within a department, or even all courses of a given type. The answer must depend largely upon the individual course and upon the type of teaching applied to it. For the purpose of this study, recourse has been had to the prevailing practice of a given department. Any section whose size was radically below the central tendency in that course was considered a small class; similarly, any section markedly above the average for that course was classed as large.

This policy has resulted in a much wider range in some courses than in others. Where the course is a rapidly growing one, such as Educational Psychology, the size of the small class in a later experiment may have been quite close to the size of what had previously been taken as a large class. This was done deliberately for the purpose of pushing the inquiry toward a discovery of the optimum size of class in a given course. A few of the experiments, therefore, may perhaps more properly be called comparisons of medium versus large classes rather than small versus large.

In brief, then, the intention in selecting experimental sections has been to have the difference in size between the smaller and the larger class so much greater than any other variable in the experiment that any variation in results is more likely to be due to difference in size than to any other factor.

Types of Procedure Followed

The ideal type of experiment would, of course, be that in which all conditions and factors are kept under strict control. Due to scheduling and other difficulties, this ideal has not been attained in any of the experiments hereinafter reported. In lieu of perfection, they have been as carefully controlled as possible. Both administrators and instructors have frequently gone to considerable trouble for the sake of sound experimentation. Three general procedures have been followed.

A. Courses were selected in which it was possible to find a large mobile student body. Each student in the small section was carefully paired *in advance* with a student in the large section, the pairing being done on two main criteria, usually intelligence and scholarship. Sex, class, and, so far as possible, all other elements of homogeneity in student personnel were kept constant. The large section was as decidedly large as the small was small. Examples of this type of experiment are numbers 1, 2, 3, 28, 29, 48, and 49.

B. Courses were selected in which might be found classes in the same quarter varying significantly in size. No attempt was made to keep the central tendency and variability of the two groups alike except as conditioned by the usual student election. No pairing was done in advance. As many students in the small sections were matched with those in the large sections as could be adequately matched on the pairing factors. The small or large section was sometimes utilized as half of more than one experiment. If possible, the matching was performed before the final criterion for the class was determined. In each experiment all of the data on each student were transferred to 4 by 6 cards for convenience in handling. The cards for each group were arranged in order of the intelligence factor (P.F.1) which, together with the scholarship factor (P.F.2), was always to be found at the top of the cards. The final criterion (F.C.) was always entered at the bottom of the card. The students from each section were selected on the bases of P.F.1 and P.F.2, the differences of which were kept within as narrow limits as possible. To obviate the influence of unconscious bias, the F.C. for each student was kept concealed until the matching had been completed. In experiments No. 4, 5, 6, 7, 8, 9, 10, 11, 12, 28a, 28c, 29a, 29b, 34, 35, 36, 37, 41, 42, 45, 46, and 47 the pairing was not performed by the experimenter but by two entirely disinterested persons. As a test of objectivity of pairing, the matching in one experiment was carried forward independently by the experimenter and by a disinterested person. With the exception of one pair the matched groups were identical.

Examples of this type of procedure are experiments No. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 30a, 30b, 31, 33, 35, 37, 40, 41, 43, 52, 53, and 54.

C. In the third type of experiment, instructor and course were kept constant but the large and the small sections were not conducted during the same quarter. Otherwise the procedure followed was identical with that described in B above. Examples of this third type are experiments No. 32, 34, 36, 38, 39, 42, 44, 45, 46, 47, 50, and 51.

Examples of Experiments

Undoubtedly some of the most carefully controlled experiments in the entire series were No. 1, 2, and 3, in General Psychology. These were initiated by Professor W. S. Foster and were carried forth by him and his colleague, Miss Edna Heidbreder. Their experimental procedure is most clearly explained in the preliminary report, written by Professor Foster himself and submitted as a portion of the Report of the Subcommittee on Class Size.

Preliminary Report on an Investigation of the Relationship between Size of Class and Efficiency of Instruction in Recitation Sections of Elementary Psychology

W. S. Foster

The present experiment is a start. It makes no pretense at being an investigation of sufficient adequacy or completeness to permit valid general conclusions to be drawn, even for the particular course considered. It is reported for suggestion and criticism on the ground of *technique*.

Elementary Psychology is a two-quarter course, conducted as a Monday-Wednesday lecture (attendance 669) and a recitation period either Thursday, Friday, or Saturday. There are 19 such recitation sections, with an average enrollment of 35. Lectures interpret the textbooks used and supplement them considerably with fact, theory, concrete illustration, and demonstration.

The experimental sections are four in number. Two, a large (60) and a small (30), are conducted by an instructor who prefers small sections; and two similar groups are handled by an instructor who prefers large classes. The students, chiefly sophomores, are allocated to these sections *before* the first class meetings and form normally distributed groups. They are chosen, without their knowledge, on the bases of (1) previous scholarship and (2) record on intelligence tests given at the time of their entrance to the University of Minnesota.

For each student in the smaller (30) section a preferred (P) student, matching him very closely in both previous scholarship and intelligence, is assigned to the larger section (60). The remaining 30 students in the larger section form a group of alternates (A) who also match, individual

for individual, the members of the smaller group. The sections are also matched for sex, class, and college.

The experimental sections taught by one instructor meet for recitation—small class at the second hour on Thursday, large class at the same hour on Friday. Those taught by the other instructor meet—large class at the first hour on Friday, small class at the first hour on Saturday. Time of day and order of instruction are thereby equalized. Both instructors teach non-experimental sections of the same course before meeting the experimental sections, so that practice on the instructor's part, if significant, is minimized. Each instructor's teaching method is held as nearly as possible constant for the two experimental sections, the chief difference in this regard appearing to be the less time or opportunity given to individual students in the large section for asking and answering questions.

Marks are based upon (1) a ten-minute "old-style" written quiz given every section at the beginning of each weekly class meeting and (2) objective mid-quarter and final examinations. Care is taken to equate as nearly as possible the difficulty of the quizzes and to see that they are scored without knowledge on the grader's part of the identity of the writer. Generally a single reader marks all of the quiz papers of both experimental sections for one instructor. The objective examinations are carefully prepared and are graded by a large number of trained instructors, each of whom reads a part of the examination only.

Before we shall think it justifiable to draw general conclusions regarding class size even in Psychology 1f, 2w, we consider it essential that consistent results shall be obtained over a considerable period (two or three classes of two quarters each) from a larger number (five or six) of different instructors, each of whom employs a somewhat different procedure in conducting recitations.

It had been planned to carry this same careful technique forward over a period of years, and it actually was pursued through two quarters. Plans were rudely interrupted by the sudden death of Professor Foster, who had handled the entire statistical manipulation of the data and who had kept all of the materials of the experiments. Through the courtesy of Professor Elliott, chairman of the Department of General Psychology, the subcommittee was permitted full access to such of Professor Foster's notes as could be located. After careful effort it was found impossible to reconstruct the experiments in their entirety; hence no attempt is made to submit a detailed analysis of the projects.

Fortunately, however, the results of all three of the experiments—two by Mr. Foster and one by Miss Heidbreder—could be

TABLE CXV

RESULTS OF CAREFULLY CONTROLLED EXPERIMENT WITH LARGE AND SMALL CLASSES USING DOUBLE-PAIR TECHNIQUE, GENERAL PSYCHOLOGY, 1F, 1924*

Criterion	Paired Groups in Small Section (25)	Paired Groups in Large Section		Advantage—Amount and Favor Of
		Preferred	Alternate	
1. Average of total scores in ten 10-minute quizzes..........	1.9	1.9	2.03	None
2. Average of total scores on objective mid-quarter examination	60.6	61.1	65.4	1% to large
3. Average of total scores on objective final examination	110.0	116.0	111.5	5% to large
4. Average point score in course †	1.94	2.04	2.10	5% to large

* Data drawn from notes of Professor W. S. Foster.

† Weights given—

8 times average of 10-minute quiz
2 times final objective examination
1 times mid-quarter objective examination

TABLE CXVI

RESULTS OF CAREFULLY CONTROLLED EXPERIMENT WITH LARGE AND SMALL CLASSES USING PREFERRED AND ALTERNATE PAIRED-GROUP TECHNIQUE, IN GENERAL PSYCHOLOGY, 1W, 1924*

Criterion	Paired Groups in Small Section (21)	Paired Groups in Large Section		Advantage—Amount and Favor Of
		Preferred	Alternate	
1. Average of total scores in ten 10-minute quizzes..........	2.17	2.06	2.01	5% to small
2. Average of total scores on objective mid-quarter examination	66.0	67.6	65.0	2% to large
3. Average of total scores on objective final examination	90.8	96.0	95.2	5% to large
4. Average point score on course †	2.14	2.24	2.08	5% to large

* Data drawn from notes of Professor W. S. Foster.

† Weights assigned in point score——

8 times average of 10-minute quiz
2 times final objective examination
1 times mid-quarter objective examination

TABLE CXVII

RESULTS OF CLASS-SIZE EXPERIMENT No. 3 IN GENERAL PSYCHOLOGY, 1F, 1924 (Miss Heidbreder cooperating)*

Section	No. of Pairs	Average Score On: Ten 10-Minute Quizzes	Objective Mid-Quarter	Objective Final
Large	22	2.1 (C)	65.6 (C+)	120.6 (C+)
Small	22	1.8 (D+)	52.3 (C−)	110.8 (C)
Advantage to large		.3	13.3	9.8

*Reported by Professor W. S. Foster.

definitely determined. The findings of the former's fall-quarter unit are presented in Table CXV and the results of his winter-quarter project are shown in Table CXVI. It will be noted that in each case the advantage, though slight, appears to rest with the larger sections. The small group is equal or slightly superior to the large on the ten-minute essay-type quizzes, but the large group has an advantage on the mid-quarter and final objective examinations. The alternate paired group of the large class was superior in one case and decidedly inferior in the other.

The bare findings of Miss Heidbreder's experimental groups are displayed in Table CXVII. This experiment was as carefully controlled as were those of Professor Foster. Miss Heidbreder's results are significantly in favor of her large section. On all three bases—ten-minute essay-type quizzes, objective mid-quarter, and objective final examination—the small group was excelled by the large.

The procedure in the three experiments was kept as nearly uniform as possible. Both Professor Foster and Miss Heidbreder were prompted by a scientific attitude. The chief difference, so far as the experiments were concerned, was that the former preferred small groups while the latter had a mild predilection for large classes.

The small classes were considerably smaller than the average section in General Psychology and the large classes were decidedly larger. Yet, in spite of the marked difference in size, the students in the large groups achieved on all measured aspects of instruction equally as well as the members of the small groups. Be it remem-

TABLE CXVIII

SUMMARY OF RESULTS IN 27 CLASS-SIZE EXPERIMENTS IN THE COURSE IN GENERAL PSYCHOLOGY, 1F AND 2W, OVER THE PERIOD 1924-26

Experiment No.	Instructor Cooperating	Quarter	Year	Size of Classes		No. of Pairs	Difference in Means of F.C.	Experimental Coefficient	Approximate Chance Value	Results in Favor Of
				L	S					
1	Mr. Foster	f	1924	60	30	25	.10	*	*	Large
2	Mr. Foster	w	1924	50	25	21	.10	*	*	Large
3	Miss Heidbreder	f	1924	60	30	22	9.8	*	*	Large
4	Mr. Foster	f	1924	54	30	16	7.2	.3623	3.9 to 1	Large
5	Mr. Foster	f	1924	54	27	11	.9	.0369	Even	Large
6	Miss Heidbreder	f	1924	40	28	19	16.3	.9818	160 to 1	Large
7	Miss Heidbreder	f	1924	40	27	13	6.0	.2933	2.5 to 1	Large
8	Miss Heidbreder	f	1924	40	24	12	16.6	.7507	38 to 1	Large
9	Mr. Foster	f	1925	48	27	14	.8	.0363	Even	Small
10	Mr. Foster	f	1925	48	25	18	3.4	.2083	2.5 to 1	Small
11B	Mr. Bird	f	1925	46	25	16	11.7	.8245	75 to 1	Large
12	Mr. Woodrow	f	1925	59	21	11	3.36	.1043	1.6 to 1	Small
25	Mr. Woodrow	w	1925	35	21	12	6.1	.2636	2.5 to 1	Large
26	Mr. Woodrow	w	1925	59	21	11	2.9	.1636	1.6 to 1	Large
27	Mr. Woodrow	w	1925	59	24	13	5.2	.2922	2.5 to 1	Large
13	Miss Heidbreder	f	1926	56	23	15	.9	.0416	Even	Small
14	Miss Heidbreder	f	1926	40	23	12	4.5	.1644	1.6 to 1	Large
15	Miss Heidbreder	f	1926	56	30	17	8.7	.4237	6.5 to 1	Large
16B	Mr. Langlie	f	1926	35	22	9	3.0	.2461	2.5 to 1	Large
17	Mr. Langlie	f	1926	40	26	15	9.8	.4109	6.5 to 1	Large
18B	Mr. Langlie	f	1926	40	22	12	10.4	.5323	11 to 1	Large
19	Mr. Langlie	f	1926	40	26	16	6.5	.3186	3.9 to 1	Large
20	Miss Shirley	f	1926	38	22	12	2.5	.0912	1.6 to 1	Large
21	Miss Shirley	f	1926	38	25	14	12.8	.6895	20 to 1	Large
22B	Mr. Jacobsen	f	1926	35	25	14	6.4	.4188	6.5 to 1	Large
23	Mr. Jacobsen	f	1926	71	28	16	8.4	.4484	6.5 to 1	Large
24	Mr. Jacobsen	f	1926	71	27	18	15.7	.708	38 to 1	Large

*Experiments carried forward by Professor Foster. Insufficient data given to compute E.C. and Chance Value.

B Sections open mainly to business students.

bered, too, that the students were exactly paired, man for man, in double ranks on both intelligence and scholarship. They were also carefully paired as to sex; practically all were sophomores; and their interests were fairly homogeneous. As nearly as possible, they were similar groups. The teaching procedure was kept constant except for the slightly greater opportunity for contact and discussion in the smaller classes. This, according to the questionnaire replies from both students and instructors, if it exerts any effect at all, should favor the smaller groups. Yet we find that the paired students, 25 in the class of 60 (which size is nearly twice as large as the ordinary section), apparently were not at all handicapped by the increased size of their group. This evidence is repeatedly substantiated by subsequent controlled experiments. It is also in complete accord with the findings in Chapter IV.

Other Experiments in General Psychology

With the splendid cooperation of the Department of Psychology, experiments were continued in the same course over a period of three years in an effort to throw more light on the problem. The

TABLE CXIX

Key for Converting an Experimental Coefficient into a Statement of Chance

(After McCall)

Experimental Coefficient	Approximate Chances
.1	1.6 to 1
.2	2.5 to 1
.3	3.9 to 1
.4	6.5 to 1
.5	11 to 1
.6	20 to 1
.7	38 to 1
.8	75 to 1
.9	160 to 1
1.0	369 to 1
1.1	930 to 1
1.2	2350 to 1
1.3	6700 to 1
1.4	20000 to 1
1.5	65000 to 1

general results are displayed in Table CXVIII. Twenty-seven separate studies involving 54 classes, 7 different instructors, 1,312 students in large classes, 684 students in small classes, and 405 paired students in each type of class, are summarized.[2]

Out of 27 studies, results in 23 experiments, or 85 per cent, are in favor of the large sections. Students seem actually to achieve better in large groups than they do in small. But how much better?

The absolute differences between the means of the final criteria, which in most cases are the scores on final objective examinations, vary widely. To provide a more adequate means of interpreting the significance of this difference, recourse has been had to McCall's Experimental Coefficient.[3] The formula for this coefficient, which furnishes a convenient summarizing index, is *difference of the means divided by 2.78 times the standard deviation of the difference.* In the conventional form, this reads:

$$\text{Experimental Coefficient} = \frac{D_m}{2.78 \times \sigma \text{ diff}}$$

It is so constructed that an experimental coefficient of 1.0 means that one can be practically certain that the difference is a significant one.

McCall has also provided a convenient table by which it is possible to convert given experimental coefficients into statements of chance. This table is reproduced herewith, as Table CXIX. This table says, for example, that when the experimental coefficient is .1 the chances are only 1.6 to 1 that the difference of the means is significant. In such a case the conclusion is warranted that the difference is not very significant. When the E.C. is 1.0 the chances become 369 to 1, whereupon it may be claimed that the difference is almost certainly a significant one. Even when the E.C. is less than 1 we are justified in stating that the factor in whose favor the difference exists is probably more effective than the other factor, since so long as the E.C. is above zero the true difference more probably lies in the direction of the obtained difference than in the opposite direction. But the nearer the E.C. approaches

[2] The actual number of separate students is smaller, due to overlapping of groups in the experiments and to the fact that the same student may have been used in more than one experiment.

[3] W. A. McCall, *How to Experiment in Education*, pp. 154-58.

zero the less and less probability there is that the obtained difference is not subject to reversal. The significance of the experimental coefficient is undoubtedly increased when, in a series such as we have, the evidence points so strongly in the same direction. In reporting the experimental results the chance values will hereinafter be given in conformity with the value of the first whole number; hence they are all conservatively stated.

With these facts in mind, let us turn back to Table CXVIII. Only in experiments No. 6, 8, 11, 21, and 24 may the results be said to be significantly in favor of the large classes. In the others the chance element is so high that we are probably justified in saying only that the results are strongly suggestive of the superiority of the large groups. Only experiments No. 9, 10, 12 and 13 show results favorable to the smaller classes. In none of them is the difference very significant, since the largest approximate chance value is 2.5 to 1. Little evidence of a constant factor due to the personality of the instructor can be detected, since the same instructors produced results in favor of both large and small classes.

The four experiments, involving eight sections, organized primarily for pre-business students, all eventuate in favor of the large sections.

Detailed Experiment Illustrated

To illustrate the technique applied, a typical experiment will be traced through. The study presented is one in which the results slightly favored the small section. The experiment was carried on during the fall of 1926 with Miss Edna Heidbreder cooperating. The large group included 56 students, the small, 23.

Table CXX shows, in item 4, that the entire large group had an average percentile rank in intelligence of 55.4 with a standard deviation of 31.1, while the small group was somewhat higher with a mean of 59.5 and an S.D. of 32.5. The opposite is true of scholarship. The difference, however, is not markedly in favor of the large section. Both groups have close to a C average mark. The variability of the two groups in both intelligence and scholarship is approximately equal.

From the small group of 23 students it was possible to find only 15 who could be closely matched with 15 students in the large

section. The central tendency and variability of these paired groups are given in section 6 of Table CXX.

TABLE CXX

SUMMARY OF EXPERIMENT NO. 13

1. Subject, General Psychology
2. Instructor, Miss Edna Heidbreder, Assistant Professor of Psychology
3. Sections

Sections	No.	Size	Quarter
a. Large	2	56	Fall, 1926
b. Small	7	23	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	55.4	31.1	2.95	.67	96.4	23.3
Small	59.5	32.5	3.20	.74	97.3	27.1

5. Number of pairs, 15
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	63.1	31.7	3.12	.64	96.3	20.7
Small	63.3	31.7	3.10	.60	97.2	21.9

7. Difference of the means in final criteria, .9
8. Difference is in favor of small group
9. Experimental coefficient, .4157
10. Approximate chance value is even

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXI

EXPERIMENT No. 13

Paired Groups in General Psychology 1f, Sections 2 and 7, 1926

(Miss E. Heidbreder cooperating)

	Large Section, 2 (56)				Small Section, 7 (23)			
Pair No.	Student No.	P.R. in Intell.	Mark Points	Final Obj.	Student No.	P.R. in Intell.	Mark Points	Final Obj.
1	2	98	3.55	112	21	98	3.65	99
2	5	93	2.55	90	2	92	2.62	132
3	6	91	2.26	151	1	92	2.23	131
4	8	91	3.22	90	5	89	3.12	84
5	9	89	1.88	115	3	90	1.95	122
6	11	86	3.00	102	7	87	3.00	87
7	13	84	2.91	103	9	83	2.81	93
8	14	83	2.60	112	8	87	2.67	117
9	18	77	2.64	93	18	73	2.64	85
10	28	41	3.90	87	11	47	3.77	77
11	30	34	4.17	90	12	33	4.00	77
12	31	28	3.75	71	13	32	3.66	118
13	33	27	3.00	94	22	24	3.00	87
14	40	19	3.88	66	16	17	3.79	97
15	44	5	3.48	69	17	5	3.58	52
	Average	63.1	3.12	96.3		63.3	3.10	97.2
	S.D.	31.71	.64	20.71		31.71	.60	21.92

Difference of means, .9. Experimental coefficient, .0416.
Difference is in favor of small sections.
Approximate chance value is even.

Table CXXI is offered to show how closely the paired students were matched, and is to be read as follows: Student No. 2 in the large class was matched with Student No. 21 in the small class. No. 2 of the large class had a mark-point average in his entire freshman year of 3.55 (P.F.2), while No. 21 of the small class had 3.65 (P.F.1). Student No. 2 of the large class had a percentile rank of 98 among entering freshman students of the University, while his mate in the small group had also 98. He made a final objective score of 112 points (F.C.) to his mate's 99. In a similar manner, Student No. 5 in the large section was matched with No. 2 in the small, the two being kept as closely alike as possible in both pairing factors.

TABLE CXXII

EXPERIMENT No. 13

Distribution of Percentile Ranks in Intelligence in Sections 2 and 7 and the Paired Groups from Each Section in General Psychology, 1f, 1926 (Miss Heidbreder cooperating)

Percentile Ranks in Intelligence	Frequencies			
	Entire Groups		Paired Groups	
	Sec. 2 (56)	Sec. 7 (23)	Large sec.	Small sec.
100				
90	8	4	4	4
80	7	6	4	4
70	9	1	1	1
60	2	0	0	0
50	5	0	0	0
40	2	1	1	1
30	2	2	1	2
20	9	3	2	1
10	2	2	1	1
0	6	1	1	1
Cases	52	20	15	15
Mean	55.4	59.5	63.1	63.3
S.D.	31.1	32.5	31.7	31.7

The P.F.1, P.F.2, and F.C.'s were averaged, with the results shown at the bottom of the table. The two groups had almost exactly the same central tendency in both pairing factors. The dispersion of the groups was also much alike, the widest variance being in mark points. Based upon this twofold criterion, intelligence and scholarship, the two groups, not only as groups but man-to-man, are as nearly alike as it is possible to find two groups of students. To all intents and purposes, the only variable factor free to operate is class size.

The final criteria are the scores on the final objective test. Here we find that the small section has an average score of 97.2, the large of 96.3. The difference is in favor of the smaller group. The experimental coefficient is .0416, which means that the chances of the difference's being significant are only slightly above 1 to 1. This is very low; consequently we are justified in concluding that although the results are in favor of the smaller section, the difference has little significance.

TABLE CXXIII
EXPERIMENT No. 13
Distribution of Average Mark Points in Sections 2 and 7 and the Paired Groups from Each Section in General Psychology, 1f, 1926
(Miss Heidbreder cooperating)

Average Mark Points	Frequencies			
	Entire Groups		Paired Groups	
	Sec. 2 (56)	Sec. 7 (23)	Large sec.	Small sec.
4.25	1	2		
4.00	1	2	1	1
3.75	5	2	3	2
3.50	4	3	1	3
3.25	6	0	1	0
3.00	10	4	3	3
2.75	5	2	1	1
2.50	6	4	3	3
2.00	6	1	1	1
1.75	2	2	1	1
1.50	1			
1.25	1			
Cases	52	22	15	15
Mean	2.95	3.20	3.12	3.10
S.D.	.67	.74	.64	.60

The entire distribution of the students in the large section, the small section, and the paired students from each section is shown for percentile ranks in Table CXXII. The same for mark points is given in Table CXXIII and for final objective scores in Table CXXIV.

Remaining Experiments in General Psychology

The summary tables for each of the other experiments in General Psychology follow (CXXV-CXLVII). The Tables of Pairs and the Distribution Tables in each criterion are on file in the University of Minnesota library. Students in General Psychology are assigned to sections in the order of registration, no attempt being made to section them on the basis of ability. For this reason, in seven of the experiments the students in the large section were superior in intelligence, while in the remaining seventeen the central tendency of the small class was higher.

TABLE CXXIV

EXPERIMENT No. 13

Distribution of Scores on Objective Final, Sections 2 and 7 and the Paired Groups from Each Section in General Psychology 1f, 1926
(Miss Heidbreder cooperating)

Final Objective Scores	Frequencies			
	Entire Groups		Paired Groups	
	Sec. 2 (56)	Sec. 7 (23)	Large sec.	Small sec.
160				
150	1	1	1	
140	1	0	0	
130	3	3	0	2
120	1	1	0	1
110	9	3	3	2
100	7	0	2	0
90	10	3	5	3
80	6	5	1	4
70	8	3	1	2
60	3	1	2	0
50	2	2		1
40	1			
30				
20				
10				
0				
Cases	52	22	15	15
Mean	96.4	97.3	96.3	97.2
S.D.	23.3	27.1	20.7	21.9

As will be noted in the summary tables, the central tendency of the paired groups is almost invariably higher than the means of the entire groups. The reason for this is that the students in the upper half of the distribution were easier to match than those in the lower half. The number of pairs was always contingent upon the total number of students in the small group. Each pair selected was approximately equal in intelligence and scholarship. It may be noted that the mean intelligence of the paired groups is usually slightly higher than the central tendency of the entire groups. There appeared to be more variance between relative ranks in intelligence and scholarship among the individuals in

the lower percentile ranks. Moreover, a higher proportion of the poorer students in the experimental sections canceled out or failed to take the final examination; consequently it was often difficult to find suitable mates at this level, with the result that more pairs had to be drawn from the upper ranks of intelligence.

TABLE CXXV

Summary of Experiment No. 4

1. Subject, General Psychology
2. Instructor, Mr. William S. Foster, Professor of Psychology
3. Sections

Sections	No.	Size	Quarter
a. Large	1	54	Fall, 1924
b. Small	2	30	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	64.4	25.8	1.47	.71	116.3	25.8
Small	61.9	26.7	1.09	.72	108.4	23.4

5. Number of pairs, 16
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	66.1	23.5	1.41	.60	120.7	20.3
Small	66.9	24.9	1.37	.62	113.5	20.1

7. Difference of the means in final criteria, 7.2
8. Difference is in favor of large group
9. Experimental coefficient, .3623
10. Approximate chance value is 3.9 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXVI

SUMMARY OF EXPERIMENT NO. 5

1. Subject, General Psychology

2. Instructor, Mr. Foster

3. Sections

	No.	Size	Quarter
a. Large	1	54	Fall, 1924
b. Small	3	27	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	64.4	25.8	1.47	.71	116.3	25.8
Small	57.3	25.8	1.22	.63	114.6	21.8

5. Number of pairs, 11

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	63.4	21.1	1.27	.49	107.9	19.2
Small	62.7	22.4	1.25	.42	107.0	21.8

7. Difference of the means in final criteria, .9

8. Difference is in favor of large group

9. Experimental coefficient, .0369

10. Approximate chance value is even

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXVII

SUMMARY OF EXPERIMENT NO. 6

1. Subject, General Psychology

2. Instructor, Miss Heidbreder

3. Sections

	No.	Size	Quarter
a. Large	8	40	Fall, 1924
b. Small	16	28	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	68.8	23.7	1.35	.66	126.5	18.7
Small	62.4	24.6	1.04	.58	103.2	24.1

5. Number of pairs, 19

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	67.5	21.5	1.13	.5	124.7	16.9
Small	68.2	23.4	1.12	.5	108.4	19.8

7. Difference of the means in final criteria, 16.3

8. Difference is in favor of large group

9. Experimental coefficient, .9818

10. Approximate chance value is 160 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXVIII

SUMMARY OF EXPERIMENT NO. 7

1. Subject, General Psychology

2. Instructor, Miss Heidbreder

3. Sections

Sections	No.	Size	Quarter
a. Large	1	40	Fall, 1924
b. Small	2	27	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	67.1	25.6	1.36	.67	125.5	20.2
Small	62.1	23.7	1.07	.61	110.0	19.4

5. Number of pairs, 13

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	64.2	25.8	1.52	.57	125.9	20.0
Small	64.7	24.8	1.33	.54	119.9	17.4

7. Difference of the means in final criteria, 6.0

8. Difference is in favor of large group

9. Experimental coefficient, .2933

10. Approximate chance value is 2.5 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXIX

SUMMARY OF EXPERIMENT NO. 8

1. Subject, General Psychology

2. Instructor, Miss Heidbreder

3. Sections

	No.	Size	Quarter
a. Large	1	40	Fall, 1924
b. Small	3	24	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	67.1	25.6	1.36	.67	125.5	20.2
Small	60.7	28.0	1.05	.56	122.5	17.6

5. Number of pairs, 12

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	63.7	27.3	1.03	.44	126.6	22.8
Small	62.6	28.0	1.05	.401	110.0	15.5

7. Difference of the means in final criteria, 16.6

8. Difference is in favor of large group

9. Experimental coefficient, .7507

10. Approximate chance value is 38 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXX

SUMMARY OF EXPERIMENT NO. 9

1. Subject, General Psychology

2. Instructor, Mr. Foster

3. Sections

Sections	No.	Size	Quarter
a. Large	1	48	Fall, 1925
b. Small	2	27	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	66.1	24.7	1.22	.63	90.2	22.1
Small	55.8	28.7	.80	.88	90.0	25.0

5. Number of pairs, 14

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	53.5	27.2	1.03	.51	87.1	16.1
Small	52.8	30.3	1.01	.51	87.9	24.9

7. Difference of the means in final criteria, .8

8. Difference is in favor of small group

9. Experimental coefficient, .0363

10. Approximate chance value is even

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXXI

SUMMARY OF EXPERIMENT No. 10

1. Subject, General Psychology

2. Instructor, Mr. Foster

3. Sections

Sections	No.	Size	Quarter
a. Large	1	48	Fall, 1925
b. Small	3	25	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	66.1	24.7	1.22	.64	90.21	22.1
Small	59.2	22.7	1.19	.61	89.4	17.2

5. Number of pairs, 18

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	65.6	23.2	1.28	.57	89.4	17.1
Small	65.0	21.9	1.24	.61	92.8	18.1

7. Difference of the means in final criteria, 3.4

8. Difference is in favor of small group

9. Experimental coefficient, .2083

10. Approximate chance value is 2.5 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXXII

SUMMARY OF EXPERIMENT No. 11

1. Subject, General Psychology

2. Instructor, Mr. Charles Bird, Assistant Professor of Psychology

3. Sections

	No.	Size	Quarter
a. Large	4 B	46	Fall, 1925
b. Small	7 B	25	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	54.7	31.7	.97	.61	84.1	16.7
Small	56.7	31.7	1.23	.79	78.8	20.8

5. Number of pairs, 16

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	57.8	22.2	.83	.50	85.4	13.7
Small	58.4	22.0	.83	.51	73.7	15.1

7. Difference of the means in final criteria, 11.7

8. Difference is in favor of large group

9. Experimental coefficient, .8245

10. Approximate chance value is, 75 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXXIII

SUMMARY OF EXPERIMENT No. 12

1. Subject, General Psychology

2. Instructor, Mr. Herbert Woodrow, Associate Professor of Psychology

3. Sections

Sections	No.	Size	Quarter
a. Large	1	59	Fall, 1925
b. Small	2	21	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	57.8	28.9	1.27	.70	99.9	21.0
Small	64.4	28.0	1.36	.79	97.6	22.7

5. Number of pairs, 11

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	61	35.4	1.29	.70	90.3	28.7
Small	61.1	31.4	1.30	.70	93.6	25.6

7. Difference of the means in final criteria, 3.36

8. Difference is in favor of small group

9. Experimental coefficient, .1043

10. Approximate chance value is 1.6 to 1

Scale for Mark Points, A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXXXIV

SUMMARY OF EXPERIMENT No. 14

1. Subject, General Psychology
2. Instructor, Miss Heidbreder
3. Sections

Sections	No.	Size	Quarter
a. Large	6	40	Fall, 1926
b. Small	7	23	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	57.6	30.6	3.08	.73	94.5	24.4
Small	59.5	32.5	3.20	.74	97.3	27.1

5. Number of pairs, 13
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	64.5	31.7	3.08	.71	103.1	25.3
Small	64.5	31.0	3.09	.69	98.6	24.9

7. Difference of the means in final criteria, 4.5
8. Difference is in favor of large group
9. Experimental coefficient, .1644
10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXXV

SUMMARY OF EXPERIMENT No. 15

1. Subject, General Psychology

2. Instructor, Miss Heidbreder

3. Sections

	No.	Size	Quarter
a. Large	2	56	Fall, 1926
b. Small	19	30	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	55.4	31.3	2.95	.67	96.4	23.3
Small	60.6	30.1	2.90	.80	101.9	19.8

5. Number of pairs, 17

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	69.9	27.9	2.72	.80	112.5	19.9
Small	70.6	26.8	2.78	.79	103.8	23.1

7. Difference of the means in final criteria, 8.7

8. Difference is in favor of large group

9. Experimental coefficient, .4237

10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXXVI

SUMMARY OF EXPERIMENT NO. 16

1. Subject, General Psychology

2. Instructor, Mr. Theos A. Langlie, Instructor in Psychology

3. Sections

Sections	No.	Size	Quarter
a. Large	9b	35	Fall, 1926
b. Small	7b	22	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	58.5	25.5	2.98	.82	95.9	22.1
Small	70.6	28.1	3.00	.72	92.6	16.3

5. Number of pairs, 9

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	71.7	20.2	3.04	.54	88.9	15.5
Small	70.4	22.2	3.02	.49	85.9	8.2

7. Difference of the means in final criteria, 3.0

8. Difference is in favor of large group

9. Experimental coefficient, .2461

10. Approximate chance value is 2.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXXVII

SUMMARY OF EXPERIMENT NO. 17

1. Subject, General Psychology
2. Instructor, Mr. Langlie
3. Sections

Sections	No.	Size	Quarter
a. Large	14	40	Fall, 1926
b. Small	12	26	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	57	29.1	2.90	.76	100.6	22.4
Small	57.5	27.1	2.78	.67	101.2	21.6

5. Number of pairs, 15
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.1	28.4	2.85	.72	106.6	24.1
Small	56.4	31.0	2.85	.72	96.8	22.9

7. Difference of the means in final criteria, 9.8
8. Difference is in favor of large group
9. Experimental coefficient, .4109
10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXXVIII

SUMMARY OF EXPERIMENT No. 18

1. Subject, General Psychology

2. Instructor, Mr. Langlie

3. Sections

Sections	No.	Size	Quarter
a. Large	8b	40	Fall, 1926
b. Small	7b	22	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	55.3	28.4	3.14	.90	92.2	24.3
Small	70.6	28.1	3.00	.72	92.6	16.3

5. Number of pairs, 12

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	66.6	30.9	3.05	.71	100.5	17.2
Small	66.5	31.1	3.03	.65	90.1	17.2

7. Difference of the means in final criteria, 10.4

8. Difference is in favor of large group

9. Experimental coefficient, .5323

10. Approximate chance value is 11 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXXXIX

SUMMARY OF EXPERIMENT NO. 19

1. Subject, General Psychology

2. Instructor, Mr. Langlie

3. Sections

Sections	No.	Size	Quarter
a. Large	14	40	Fall, 1926
b. Small	5	26	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	57	29.1	2.90	.76	100.6	22.4
Small	61.5	27.3	2.70	.70	99	22.6

5. Number of pairs, 16

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.6	28.8	2.87	.47	100.2	17.7
Small	57.0	30.4	2.88	.51	93.7	23.4

7. Difference of the means in final criteria, 6.5

8. Difference is in favor of large group

9. Experimental coefficient, .3186

10. Approximate chance value is 3.9 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXL

SUMMARY OF EXPERIMENT No. 20

1. Subject, General Psychology

2. Instructor, Miss Mary Shirley, Instructor in Psychology

3. Sections

Sections	No.	Size	Quarter
a. Large	11	38	Fall, 1926
b. Small	17	22	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	47.9	29.8	2.81	.77	93.7	23.8
Small	54.5	27.1	3.05	.95	92	23.8

5. Number of pairs, 12

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	73.2	27.5	2.58	.85	110.3	25.5
Small	73.3	25.0	2.65	.80	107.8	22.8

7. Difference of the means in final criteria, 2.5

8. Difference is in favor of large group

9. Experimental coefficient, .0912

10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLI

Summary of Experiment No. 21

1. Subject, General Psychology
2. Instructor, Miss Shirley
3. Sections

Sections	No.	Size	Quarter
a. Large	15	38	Fall, 1926
b. Small	18	25	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.6	26.0	2.54	.94	100.3	21.4
Small	61.7	22.6	2.61	.79	92.2	19.3

5. Number of pairs, 14
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	68.1	18.3	2.71	.75	104.3	17.1
Small	67.8	18.0	2.71	.71	91.5	18.2

7. Difference of the means in final criteria, 12.8
8. Difference is in favor of large group
9. Experimental coefficient, .6895
10. Approximate chance value is 20 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLII

SUMMARY OF EXPERIMENT NO. 22

1. Subject, General Psychology
2. Instructor, Mr. Carlyle Jacobsen, Instructor in Psychology
3. Sections

Sections	No.	Size	Quarter
a. Large	4b	35	Fall, 1926
b. Small	2b	25	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	49.5	26.8	3.05	.64	95.0	23.7
Small	53.3	26.3	3.34	.62	80.2	14.4

5. Number of pairs, 14
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	47.6	28.3	3.03	.48	88.1	18.5
Small	48.5	28.1	3.05	.54	81.7	9.0

7. Difference of the means in final criteria, 6.4
8. Difference is in favor of large group
9. Experimental coefficient, .4188
10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLIII

SUMMARY OF EXPERIMENT NO. 23

1. Subject, General Psychology

2. Instructor, Mr. Jacobsen

3. Sections

	No.	Size	Quarter
a. Large	8	71	Fall, 1926
b. Small	1	28	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	48.9	27.1	3.19	.88	92.7	23.8
Small	58.7	27.9	3.04	.80	93.9	21.5

5. Number of pairs, 16

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Objective Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	53.9	25.4	3.07	.53	100.1	20.9
Small	54.8	26.9	3.07	.48	91.7	17.0

7. Difference of the means in final criteria, 8.4

8. Difference is in favor of large group

9. Experimental coefficient, .4484

10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLIV

SUMMARY OF EXPERIMENT NO. 24

1. Subject, General Psychology

2. Instructor, Mr. Jacobsen

3. Sections

Sections	No.	Size	Quarter
a. Large	8	71	Fall, 1926
b. Small	20	27	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Intell. P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	48.9	27.1	3.19	.88	92.7	23.8
Small	54.6	29.3	3.24	1.13	91.2	30.3

5. Number of pairs, 18

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Intell. P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	49.8	28.0	3.16	.92	102.7	20.8
Small	50.3	28.8	3.15	.84	87.0	26.7

7. Difference of the means in final criteria, 15.7

8. Difference is in favor of large group

9. Experimental coefficient, .708

10. Approximate chance value is 38 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLV

Summary of Experiment No. 25

1. Subject, General Psychology

2. Instructor, Mr. Woodrow

3. Sections

Sections	No.	Size	Quarter
a. Large	2	35	Winter, 1927
b. Small	14	21	Winter, 1927

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	58.5	26.3	2.91	.90	85.9	16
Small	63.2	28.8	2.73	.82	83.2	22.3

5. Number of pairs, 12

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	58.8	26.3	2.71	.92	86.9	15.0
Small	58.9	27.2	2.70	.90	80.8	23.2

7. Difference of the means in final criteria, 6.1

8. Difference is in favor of large group

9. Experimental coefficient, .2636

10. Approximate chance value is 2.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLVI

SUMMARY OF EXPERIMENT NO. 26

1. Subject, General Psychology

2. Instructor, Mr. Woodrow

3. Sections

Sections	No.	Size	Quarter
a. Large	5	59	Winter, 1926
b. Small	14	21	Winter, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.3	27.9	2.84	.86	89.4	18.6
Small	63.2	28.8	2.73	.82	83.2	22.3

5. Number of pairs, 11

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	61.9	29.5	2.55	.69	90.6	14.3
Small	62.5	31.1	2.56	.66	87.7	15.6

7. Difference of the means in final criteria, 2.9

8. Difference is in favor of large group

9. Experimental coefficient, .1636

10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXLVII

Summary of Experiment No. 27

1. Subject, General Psychology

2. Instructor, Mr. Woodrow

3. Sections

Sections	No.	Size	Quarter
a. Large	5	59	Winter, 1926
b. Small	3	24	Winter, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.3	27.9	2.84	.86	89.4	18.6
Small	72.6	20.7	2.88	.81	84.1	19.5

5. Number of pairs, 13

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	68.6	18.5	2.58	.65	91.0	11.7
Small	69.7	17.8	2.59	.67	85.8	19.9

7. Difference of the means in final criteria, 5.2

8. Difference is in favor of large group

9. Experimental coefficient, .2922

10. Approximate chance value is 2.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

Class-Size Experiments in the Law School

The second group of carefully controlled experiments was carried on in two required freshman Law courses in the winter of 1924. One experiment was conducted by Professor Justin Miller in the course on Criminal Law with groups of 79 and 24; the other

TABLE CXLVIII

Central Tendency and Variability in the Moore Intelligence Test, Average S.L.A. Honor Points, and Average Fall-Quarter Law Grades of the Various Groups of Law Freshmen, Winter Quarter, 1924-25

Criterion		All Law Fresh. (103)	Contracts		Criminal Law	
			Large (73)	Small (30)	Large (79)	Small (24)
Moore Completion	M.	24.3	24.1	24.7	24.5	23.6
Test	S.D.	6.5	6.3	6.9	6.4	6.7
S. L. A. av.	M.	1.363	1.364	1.367	1.367	1.373
honor points	S.D.	.498	.476	.55	.505	.487
Av. fall-quarter	M.	3.125	3.111	3.145	3.129	3.117
Law grades	S.D.	.592	.577	.640	.611	.422

TABLE CXLIX

Distribution on Moore Completion Test of Law Freshmen in Large and Small Sections of Criminal Law and Contracts, Winter Quarter, 1924

Score	Frequencies			
	Criminal Law		Contracts	
	Large sec.	Small sec.	Large sec.	Small sec.
36-	2	1	2	1
33	7	1	5	3
30	9	2	7	4
27	12	3	11	4
24	11	5	12	4
21	10	3	10	3
18	12	5	12	5
15	14	2	11	5
12	1	1	2	0
9	1	0	0	1
6		1	1	
Cases	79	24	73	30
Mean	24.5	23.6	24.1	24.7
S.D.	6.4	6.7	6.3	6.9

by Professor Thomas Lavery in the course on Contracts with classes of 73 and 30. Both courses are old and well established and both were taught by the case method, a combination of lecture, quiz, and class comment between students and instructor. As far as interests were concerned, the students, all of whom were freshman law students, were homogeneous. They had all passed through the first-quarter elimination period in which their number had been reduced from 121 to 103.

Before the end of the fall quarter the students were subjected to a battery of tests composed of the following five elements:

1. Moore Completion Test
2. An opposites test
3. An arithmetic reasoning test
4. A vocabulary test
5. Sigma 10 Reading Examination

The first four make up what is usually called the University of Minnesota Freshman Intelligence Test, devised by Professor D. G. Paterson.

TABLE CL

Distribution of Total Final Ranking in Initial Tests of Law Freshmen in Large and Small Sections of Criminal Law and Contracts, Winter Quarter, 1924

Combined Ranks in I. T.	Frequencies			
	Criminal Law		Contracts	
	Large sec.	Small sec.	Large sec.	Small sec.
490-5	1		1	
450	5		4	1
410	3	2	4	1
370	2	3	3	2
330	13	1	11	3
290	7	3	7	3
250	10	6	9	7
210	11	2	9	4
170	7	3	8	2
130	6	2	6	2
90	9	1	8	2
50	4	0	2	2
10	1	1	1	1
Cases	79	24	73	30
Mean	258.3	266.7	264.0	251.3
S.D.	114.9	99.9	113.3	107.2

TABLE CLI

Distribution of Average S.L.A. Honor Points in the Large Section and the Small Section in Criminal Law and in Contracts, Winter Quarter, 1924

S. L. A. Honor Points	Frequencies: Criminal Law, Large sec. (78)	Criminal Law, Small sec. (24)	Contracts, Large sec. (73)	Contracts, Small sec. (20)
2.90-3.09		1	1	
2.70	2	0	1	1
2.50	2	0	1	1
2.30	0	0	0	0
2.10	2	1	2	1
1.90	6	0	4	2
1.70	7	1	6	2
1.50	7	2	5	4
1.30	12	7	12	7
1.10	14	6	16	4
.90	17	3	17	3
.70	5	2	5	2
.50	4	1	2	3
Cases	78	24	72	30
Mean	1.367	1.373	1.364	1.367
S.D.	.505	.487	.476	.55

The students were ranked on each test. The sum of all five ranks will hereinafter be called Rank on Tests. The average honor points during the entire Liberal Arts training were ascertained for each student. Each one who was assigned to the small section was carefully paired with another to be left in the large class.

In the assignment to sections, administrative considerations forced certain shifts; consequently some of the pairings were disrupted. This was especially true of the small class in Contracts and accounts for the small number of matched students figuring in the comparisons. As will be seen in Tables CXLVIII through CLII, the groups as finally organized were quite homogeneous as to intelligence, S.L.A. honor points, and average fall-quarter Law grades. One instructor was partial to large groups, the other to small. An effort was made to keep instructional methods uniform

in large and small sections, but the instructors reported a stronger tendency toward discussion in the smaller groups.

TABLE CLII

DISTRIBUTION OF AVERAGE FALL-QUARTER LAW GRADES IN THE LARGE SECTION AND THE SMALL SECTION IN CRIMINAL LAW AND IN CONTRACTS, WINTER QUARTER, 1924

FALL QUARTER LAW GRADES	FREQUENCIES			
	Criminal Law		Contracts	
	Large sec.	Small sec.	Large sec.	Small sec.
4.37-4.61	1	1	1	1
4.12	1	1	2	0
3.87	5	2	5	2
3.62	6	1	6	1
3.37	8	4	9	3
3.12	17	3	12	8
2.87	11	4	8	7
2.62	10	3	8	5
2.37	6	2	8	0
2.12	3	2	4	1
1.87	2	1	2	1
1.62	1	....	0	1
1.37	1	....	1	....
Cases	72	24	66	30
Mean	3.11	3.15	3.13	3.12
S.D.	.58	.64	.61	.42

TABLE CLIII

DISTRIBUTION OF FINAL MARKS IN LARGE AND SMALL SECTIONS OF CRIMINAL LAW AND CONTRACTS, WINTER QUARTER, 1924

FINAL MARKS	FREQUENCIES			
	Criminal Law		Contracts	
	Large sec.	Small sec.	Large sec.	Small sec.
A	8	2	5	....
B	15	7	8	4
C	22	6	26	15
D	19	6	16	5
E	4	1	10	6
F	2	2	1	....
Cases	70	24	66	30
Mean	3.03	3.13	3.32	3.43
S.D.	1.195	1.278	1.14	.953

A taken as 1, B as 2, C as 3, D as 4, E as 5, and F as 6.

TABLE CLIV

PERCENTAGE DISTRIBUTION OF ALL SPRING-QUARTER MARKS RECEIVED BY FRESHMAN LAW STUDENTS, WHO HAD BEEN IN THE LARGE AND THE SMALL SECTIONS IN THE WINTER-QUARTER COURSE IN CONTRACTS

Marks	Per Cent Distribution among Students Who Had Been in the Large Section	Small Section
A	5	5
B	18	18
C	34	42
D	24	24
E	15	8
F	4	2

TABLE CLV

COMPARISON OF TOTAL FRESHMAN LAW MARKS IN THE FALL QUARTER AND WINTER QUARTER, 1924-25

Marks	Distribution of Marks: Fall Quarter No.	Fall Quarter Per cent	Winter Quarter No.	Winter Quarter Per cent
A	44	8	45	8
B	87	15	84	14
C	196	34	200	34
D	148	26	142	24
E	74	13	81	14
F	23	4	33	6
Total	572	100.0	585	100.0

TABLE CLVI

SUMMARY OF RESULTS OF CLASS-SIZE EXPERIMENTS IN FRESHMAN LAW COURSES, CRIMINAL LAW AND CONTRACTS, WINTER QUARTER, 1924-25

Experiment Number	Size of Classes L.	Size of Classes S.	No. of Pairs	Difference in Means of F.C.	Experimental Coefficient	Approximate Chance Value	Results in Favor Of
28a	79	24	22	.04	.0393	Even	Small
28b	79	24	20	.05	.0469	Even	Small
28c	79	24	20	.05	.0447	Even	Large
29a	73	30	14	.36	.1263	3.9 to 1	Large
29b	73	30	14	.31	.4820	6.5 to 1	Large
29c	73	30	14	.15	.1516	1.6 to 1	Small

TABLE CLVII

Summary of Experiment No. 28a

1. Subject, Criminal Law

2. Instructor, Mr. Justin R. Miller, Professor of Law

3. Sections

	No.	Size	Quarter
a. Large	1	79	Winter, 1924
b. Small	2	24	Winter, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Av. Rank in Tests		(b) P.F. 2 Av. S.L.A. Honor Points		(c) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	51.7	23.0	1.37	.51		
Small	53.3	20.0	1.37	.49		

5. Number of pairs, 22

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Av. Rank in Tests		(e) P.F. 2 Av. S.L.A. Honor Points		(f) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	64.3	26.6	1.25	.74	3.04	1.11
Small	63.2	26.2	1.27	.75	3.00	1.31

7. Difference of the means in final criteria, .04

8. Difference is in favor of small group

9. Experimental coefficient, .0393

10. Approximate chance value is even

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLVIII

SUMMARY OF EXPERIMENT No. 28b

1. Subject, Criminal Law

2. Instructor, Mr. Miller

3. Sections

	No.	Size	Quarter
a. Large	1	79	Winter, 1924
b. Small	2	24	Winter, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Total Rank in Tests		(b) P.F. 2 Av. Fall Quarter Grades		(c) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	258.3	114.9	3.11	.58		
Small	266.7	99.9	3.15	.64		

5. Number of pairs, 20

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Total Rank in Tests		(e) P.F. 2 Av. Fall Quarter Grades		(f) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	289.8	105.8	3.50	.71	3.05	1.38
Small	290.0	106.7	3.49	.67	3.00	1.02

7. Difference of the means in final criteria, .05

8. Difference is in favor of small group

9. Experimental coefficient, .0469

10. Approximate chance value is even

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLIX

Summary of Experiment No. 28c

1. Subject, Criminal Law

2. Instructor, Mr. Miller

3. Sections

Sections	No.	Size	Quarter
a. Large	1	79	Winter, 1924
b. Small	2	24	Winter, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Av. S.L.A. H.P.		(b) P.F. 2 Fall Quarter Law Grade		(c) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	1.37	.51	3.11	.58		
Small	1.37	.49	3.15	.64		

5. Number of pairs, 20

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Av. S.L.A. H.P.		(e) P.F. 2 Fall Quarter Law Grade		(f) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	1.29	.40	3.63	.73	3.25	1.19
Small	1.31	.48	3.61	.73	3.30	1.35

7. Difference of the means in final criteria, .05

8. Difference is in favor of large group

9. Experimental coefficient, .0447

10. Approximate chance value is even

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLX

Summary of Experiment No. 29a

1. Subject, Contracts
2. Instructor, Mr. Thomas Lavery, Professor of Law
3. Sections

Sections	No.	Size	Quarter
a. Large	1	73	Winter, 1925
b. Small	2	30	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Total Rank in Intell. Tests		(b) P.F. 2 Av. S.L.A. Honor Points		(c) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	264.0	113.2	1.36	1.48		
Small	251.3	107.2	1.37	.55		

5. Number of pairs, 14
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Total Rank in Intell. Tests		(e) P.F. 2 Av. S.L.A. Honor Points		(f) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	232.53	118.88	1.56	.59	2.79	.94
Small	232.17	117.94	1.53	.58	3.14	.74

7. Difference of the means in final criteria, .355
8. Difference is in favor of large group
9. Experimental coefficient, .3994
10. Approximate chance value is 3.9 to 1

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXI

SUMMARY OF EXPERIMENT No. 29b

1. Subject, Contracts

2. Instructor, Mr. Lavery

3. Sections

	No.	Size	Quarter
a. Large	1	73	Winter, 1925
b. Small	2	30	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Rank in Tests		(b) P.F. 2 Av. Fall Quarter Grades		(c) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	264.0	113.3	3.13	.61		
Small	251.3	107.2	3.12	.42		

5. Number of pairs, 14

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Rank in Tests		(e) P.F. 2 Av. Fall Quarter Grades		(f) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	210.6	96.3	3.12	.38	2.77	.57
Small	210.7	98.3	3.13	.41	3.08	.61

7. Difference of the means in final criteria, .31

8. Difference is in favor of large group

9. Experimental coefficient, .4820

10. Approximate chance value is 6.5 to 1

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXII

SUMMARY OF EXPERIMENT No. 29c

1. Subject, Contracts

2. Instructor, Mr. Lavery

3. Sections

Sections	No.	Size	Quarter
a. Large	1	73	Winter, 1925
b. Small	2	30	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Av. S.L.A. Honor Points		(b) P.F. 2 Av. Fall Qtr. Law Grades		(c) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	1.36	.48	3.13	.61		
Small	1.37	.55	3.12	.42		

5. Number of pairs, 14

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Av. S.L.A. Honor Points		(e) P.F. 2 Av. Fall Qtr. Law Grades		(f) F.C. Final Grade	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	1.47	.40	2.93	.52	3.29	1.16
Small	1.47	.44	2.94	.51	3.14	.65

7. Difference of the means in final criteria, .15

8. Difference is in favor of small group

9. Experimental coefficient, .1516

10. Approximate chance value is 1.6 to 1

Scale for Final Marks: A-1, B-2, C-3, D-4, E-5, F-6.

The final criteria were the term marks in the course as assigned by the instructor. These marks were based upon a rather extended written report and a comprehensive essay-type final examination. Both were of the case type and were carefully evaluated by the instructor. The care with which Law grades are assigned may be demonstrated by the consistency exhibited in Tables CLIV and CLV. The "r" (coefficient of correlation) between the average fall-quarter and the average winter-quarter Law grades for 98 students was found to be .59 ± .04.

TABLE CLXIII

PAIRED GROUPS IN EXPERIMENT NO. 28A, USING TOTAL RANK IN PRELIMINARY TESTS AND AVERAGE S.L.A. HONOR POINTS AS THE BASIS OF PAIRING

(Mr. Miller cooperating)

	Large Section (79)					Small Section (24)				
Pair No.	Student No.	Rank in Tests	Av. S.L.A. Honor Points	Av. Fall Qtr. Mark	Final Mark	Student No.	Rank in Tests	Av. S.L.A. Honor Points	Av. Fall Qtr. Mark	Final Mark
1	4	99.0	.67	3.5	B	101	95.5	.51	4.2	B
2	3	95.5	.67	5.2	E	92	88.0	.67	4.0	C
3	42	94.0	1.30	3.3	D	71	97.0	1.32	4.5	D
4	31	93.0	1.04	3.2	D	81	90.0	1.02	3.6	B
5	28	86.0	1.61	3.3	D	82	83.5	1.58	3.2	B
6	73	85.0	.90	4.2	B	86	87.0	.87	3.8	C
7	6	83.5	1.43	3.8	C	62	75.0	1.39	2.0	C
8	72	80.0	1.13	3.7	C	87	80.0	1.26	3.8	C
9	29	70.0	1.00	3.2	B	90	68.0	1.01	3.3	C
10	32	67.0	.82	3.0	C	56	78.0	.79	4.3	F
11	93	66.0	.93	2.4	B	75	71.0	.96	2.8	F
12	61	65.0	1.33	2.8	C	77	62.0	1.43	3.6	B
13	100	59.0	.98	3.3	D	85	58.0	.98	4.0	D
14	25	56.0	1.06	4.0	E	78	54.5	1.11	3.3	B
15	64	52.0	1.00	4.0	C	23	54.5	1.02	2.2	C
16	50	49.0	1.21	2.3	D	95	48.0	1.17	3.7	D
17	102	45.0	2.03	2.5	A	94	42.0	2.24	2.2	A
18	18	38.0	1.20	3.8	D	33	35.0	1.24	4.2	D
19	48	39.0	1.17	2.8	C	83	34.0	1.10	3.0	A
20	24	86.0	1.76	2.8	A	74	82.	1.84	4.0	B
21	57	5.0	2.75	1.7	B	66	6.	2.91	2.0	B
22	12	1.0	1.55	3.5	C	70	2.	1.60	3.8	D
Mean		64.3	1.25	3.29	3.04		63.2	1.27	3.45	3.00
S.D.		26.6	.74	.47	1.11		26.2	.75	.52	1.31

Difference of means, .04. Experimental coefficient, .0393.
Difference is in favor of small section.
Approximate chance value is even.

The following three pairing criteria were available: (a) combined rank in five preliminary tests; (b) average honor points earned in academic career; and (c) average fall-quarter Law grades. The first two were accepted as the chief criteria and the findings are presented as Experiments 28a and 29a. But, to permit due consideration of all factors, the students in each course were also independently matched, first on (a) and (c), neglecting honor points, and then on (b) and (c) with no attention to rank on the tests. These represent Experiments 28b, 29b, 28c, and 29c, respectively. The summarized results for each course on each of the three systems of matching are given in Table CLVI. Although the number of pairs in each case was the same, neither the personnel of the matched groups nor the identity of the pairs was constant.

TABLE CLXIV

Paired Groups in Experiment No. 29a, Using Total Rank in Intelligence Tests and the Average S.L.A. Honor Points, Winter Quarter, 1925, as the Basis of Pairing

(Mr. Lavery cooperating)

	Large Section (73)					Small Section (30)				
Pair No.	Student No.	Total Rank in Intell. Tests	S.L.A. Honor Points	Av. Fall Qtr. Law Grade	Winter Contracts Grade	Student No.	Total Rank in Intell. Tests	S.L.A. Honor Points	Av. Fall Qtr. Law Grade	Winter Contracts Grade
1	66	76.5	2.91	2.0	A	57	72.0	2.75	1.66	B
2	55	165.6	2.61	1.5	A	35	167.5	2.62	2.17	C
3	54	114.0	1.99	3.6	B	98	107.5	1.95	3.33	C
4	49	195.5	1.81	2.4	C	45	187.5	1.88	3.33	D
5	82	364.0	1.58	2.8	C	28	365.0	1.61	3.33	C
6	12	15.5	1.55	3.2	C	70	19.5	1.60	3.25	D
7	2	268.0	1.49	3.33	C	8	273.5	1.52	3.0	D
8	34	479.5	1.29	4.0	D	62	347.5	1.39	2.0	C
9	87	356.0	1.26	3.25	B	18	216.5	1.20	3.25	D
10	33	211.5	1.24	4.17	C	39	475.5	1.12	3.66	D
11	16	168.0	1.07	3.0	D	19	179.5	1.08	3.0	B
12	23	269.5	1.02	2.17	C	64	264.5	1.00	3.8	C
13	100	277.5	.98	3.3	D	51	278.0	.92	3.0	B
14	93	294.5	.93	2.4	C	32	296.5	.82	3.0	C
Mean		232.53	1.556	2.937	2.785		232.17	1.533	2.984	3.14
S.D.		118.88	.59	.74	.94		117.94	.58	.60	.74

Difference in means, .355. Experimental coefficient, .3994.
Difference is in favor of large section.
Approximate chance value is 1.6 to 1.

The detailed results of the Criminal Law experiment are given in Tables CLVII, CLVIII, and CLIX. Apparently it makes little difference which matching basis is used. The difference between the means of the F.C. in two cases is slightly in favor of the small section, but on the other matching basis the advantage, equally slight, shifts to the large. In no case is the difference a significant one.

The results of the experiment in Contracts are likewise shown in Tables CLX, CLXI, and CLXII. Here we find the same conditions, only reversed. The slight advantage in two cases rests with the larger section, but on the third basis it transfers to the smaller group. No great significance attaches to either result.

The conclusion of this series of experiments must be that class size is a negligible factor, so far as direct student achievement in these courses is concerned.

The records of the paired students on the first basis are displayed in Table CLXIII for the Criminal Law group and in Table CLXIV for the classes in Contracts. The paired groups on the other two bases (Experiments Nos. 28b, 28c, 29b, and 29c) are on file in the University of Minnesota library.

Class-Size Experiments in Physics

The third group of carefully controlled experiments with matched pairs of students was launched in the Department of Physics in the fall of 1926, and was carried through under the immediate direction of Professor Henry A. Erikson, chairman of the department.

Some ten years ago the department abandoned, in the general course in Physics, the old-type recitation plan of instruction and adopted what may be called the text-lecture-demonstration method. This move was made because increasing enrollment and inadequate teaching force had caused the sections to be increased from the twenty students considered desirable, to thirty, forty, and even fifty. By the new plan a three-credit demonstration-lecture course, offered to groups of 100 150 and supplemented by a parallel but separate one-credit laboratory course, constituted the General Physics course.

TABLE CLXV

Paired Groups in Elements of Mechanics, Physics 1f, Showing Factors Considered in Pairing

Pair No.	Section	Student No.	Class Hour	Quiz Hour	Av. Mark Points	Score, Initial Test	College	Class	Age	Had Phys.	High School
1	L	147	II	9	1.82	235	Eng.	Soph.	18	No	Felton Com'l School
	S	128	III	2 or 9	1.91	238	Eng.	Soph.	19	Yes	Mech. Arts (S.D.)
2	L	76	II	2 or 9	2.33	209	Chem.	Soph.	18	Yes	Mankato
	S	140	III	9	2.35	209	Eng.	Soph.	20	Yes	Spring Valley
3	L	79	II	9	2.62	248	Chem.	Soph.	20	Yes	Dayton, Ohio
	S	47	III	9	2.63	230	Eng.	Soph.	18	Yes	Duluth Central
4	L	72	II	2 or 9	2.88	252	Eng.	Soph.	19	Yes	Central, Minneapolis
	S	26	III	9	2.92	248	Eng.	Soph.	20	Yes	Austin
5	L	37	II	9	2.98	253	Eng.	Soph.	19	Yes	Central, St. Paul
	S	102	III	9	2.96	252	Eng.	Soph.	18	Yes	Anoka
6	L	150	II	9	3.13	248	Eng.	Soph.	19	Yes	Lewiston
	S	101	III	2 or 9	3.13	249	Eng.	Soph.	20	Yes	Atwater
7	L	125	II	9	3.27	234	Eng.	Soph.	18	Yes	Stillwater
	S	33	III	9	3.26	235	Eng.	Soph.	20	Yes	East, Minneapolis
8	L	51	II	2 or 9	3.33	199	Eng.	Soph.	21	Yes	Central, St. Paul
	S	63	III	9	3.37	204	Eng.	Soph.	23	Yes	Thief River Falls
9	L	104	II	2 or 9	3.42	189	Chem.	Soph.	23	Yes	North, Minneapolis
	S	48	III	2	3.43	186	Eng.	Soph.	22	No	East, Minneapolis
10	L	1	II	9	3.67	176	Eng.	Soph.	19	Yes	New Auburn, Wis.
	S	16	III	9	3.70	176	Eng.	Soph.	19	Yes	Glendale City
11	L	106	II	2	3.98	199	Chem.	Soph.	19	Yes	Pipestone
	S	81	III	9	3.96	200	Eng.	Soph.	20	Yes	University
12	L	118	II	9	4.08	193	Eng.	Soph.	20	Yes	Plentywood, Mont.
	S	60	III	9	4.09	194	Eng.	Soph.	21	Yes	Central, St. Paul

Although the instructors in the Physics Department had the general feeling that the new method was securing results equally as good as under the old time-consuming, staff-usurping plan, they had no quantitative evidence; consequently it was determined to ascertain the truth by carrying on a series of carefully controlled class-size experiments designed to extend over a period of six successive quarters.

The experimental groups were drawn from the large reservoir of students electing the three-credit introductory course in Elements of Mechanics and Sound. The section chosen for study was a second-hour group of 150 students, chiefly sophomore engineers and chemists. The average mark points of all grades received during their freshman year were ascertained. At the first meeting of the class a carefully devised combined aptitude and general information test in Physics, consisting of 25 problems, 5 principles, 15 deductions, and 100 true-false statements, was administered. This test was designed and applied by Dr. J. W. Buchta of the Department of Physics.

Two groups of students, closely matched in general physics ability as measured by the tests and in marks points, were selected. Besides these two main criteria, the groups were also quite closely paired on such other bases as college, class, age, previous (high school) experience with physics, and quality of secondary school training (urban or rural high school). The bases of selection are shown in Table CLXV.

TABLE CLXVI

Comparative Scores in Physics, Fall Quarter, 1926-27

Av. score of all fall-quarter, 1926-27, Physics classes	70.5
Av. score of first-hour control class (75 students)	72.4
Av. score of sixth-hour control class (41 students)	73.7
Av. score of eighth-hour control class (70 students)	66.6
Av. score of all (150) students, paired and unpaired, in large second-hour experimental section	70.5
Av. score of paired students only in large second-hour experimental section	75.7
Av. score of small third-hour experimental section	69.4

TABLE CLXVII

SUMMARY OF EXPERIMENT NO. 48

1. Subject, Elements of Mechanics

2. Instructor, Mr. Henry A. Erikson, Professor of Physics

3. Sections

	No.	Size	Quarter
a. Large	2	150	Fall, 1926
b. Small	3	12	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Initial Test		(b) P.F. 2 Mark Points		(c) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	211.2	40.3	3.14	.74	72.4	13.8
Small	219.2	27.2	3.13	.61	68.4	11.8

5. Number of pairs, 12

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Initial Test		(e) P.F. 2 Mark Points		(f) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	219.2	27.2	3.13	.61	75.8	7.3
Small	218.8	25.3	3.13	.61	69.6	11.8

7. Difference of the means in final criteria, 6.22

8. Difference is in favor of large group

9. Experimental coefficient, .5587

10. Approximate chance value is 11 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXVIII

Experiment No. 49

Paired Groups in Physics 1w, Sections 8 and 7, 1926-27

(Mr. Buchta cooperating)

	Large Section, 8 (148)				Small Section, 7 (12)			
Pair No.	Student No.	Initial Test Score	Average Mark Points	Final Obj. Score	Student No.	Initial Test Score	Average Mark Points	Final Obj. Score
1	5	262	2.25	74	1	263	2.00	84
2	12	243	1.16	90	2	243	1.05	80
3	30	199	2.82	62	4	202	2.46	59
4	33	191	3.36	75	6	189	3.30	65
5	38	184	3.75	66	7	186	3.76	66
6	43	171	4.13	70	8	172	4.02	59
7	50	152	4.19	53	9	162	4.46	61
8	42	173	3.23	64	10	160	3.33	56
9	58	128	3.72	51	11	128	3.84	61
Average		189.2	3.18	67.2		189.4	3.14	65.7
S.D.		39.5	.91	11.24		39.65	1.03	9.24

Difference of means, 1.5. Experimental coefficient, .1112.
Difference is in favor of large section.
Approximate chance value is 1.6 to 1.

One of the twelve-student groups was left in the large section; the other was scheduled as a separate class, meeting at the third hour. Both sections were taught by Professor Erikson and the same text and assignments were used with both groups. An effort was made to keep instruction as uniform as possible, and, except for more formality in the large class and more questions and answers in the small, this aim was realized. Outside of the usual examinations, no coercive methods were applied to either group.

The final criterion accepted was the summary rating for the quarter. All students in both sections met weekly for a one-hour quiz. They were also marked on special written problems based upon each assignment. At the end of the quarter a two-hour objective final examination was administered. All tests were carefully read by assistants in the department. The final grade for the course was obtained by applying a weight of 3 to the quizzes and problems and a value of 1 to the final examination.

The results of the experiment are given in Table CLXVII.

TABLE CLXIX

SUMMARY OF EXPERIMENT NO. 49

1. Subject, Elements of Mechanics
2. Instructor, Mr. J. William Buchta, Assistant Professor of Physics
3. Sections

Sections	No.	Size	Quarter
a. Large	8	148	Winter, 1927
b. Small	7	12	Winter, 1927

4. Central tendency and variability of entire groups

	(a) P.F. 1 Initial Test Score		(b) P.F. 2 Mark Points		(c) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	198.8	43.6	3.49	.93	65.8	13.2
Small	187.5	40.2	3.42	.99	66.1	11.6

5. Number of pairs, 9
6. Central tendency and variability of the paired groups.

	(d) P.F. 1 Initial Test Score		(e) P.F. 2 Mark Points		(f) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	189.2	39.5	3.18	.91	67.2	11.2
Small	189.4	39.7	3.14	1.03	65.7	9.2

7. Difference of the means in final criteria, 1.5
8. Difference is in favor of large group
9. Experimental coefficient, .1112
10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

As will be noted, the central tendencies of the two groups are nearly the same in both P.F.1 and P.F.2. The paired students in the large group made a final average of 75.7 in contrast to the final average of 69.4 for the small section. This is a fairly significant difference.

The experiment was continued in the winter quarter under the direction of Professor J. W. Buchta. Out of a group of 160 students, twelve matched pairs were again selected on the same P.F.'s by an identical procedure. They were likewise matched on as many of the other criteria as possible. Unfortunately, cancelations disrupted three pairs, so only nine remained for the end results. The matched pairs are analyzed in Table CLXVIII.

Whereas Professor Erikson, who handled the fall-quarter unit of the experiment, preferred large groups, Professor Buchta had a slight leaning toward small sections. During the fall project a definite effort had been made to keep the teaching procedures uniform for both sections. In the winter quarter, while the assignments and content of the course were held constant, a deliberate attempt was made to adapt the methods of instruction to the size of the group. In the large class little opportunity was afforded for student participation, but in the small section much use was made of discussion and question-and-answers. In contrast to the fall-quarter policy, mildly coercive methods, chiefly in the form of blackboard work and question-and-answers, were applied to the small section.

The results of the winter-quarter experiment are displayed in Table CLXIX. Again they are slightly favorable to the paired students in the large group. The experiment is now being continued in the spring quarter, following much the same procedure, with Professor Erikson again in charge.[4]

[4] The results, by quarters, for the year 1926-27, are as follows:

	Fall Quarter		Winter Quarter		Spring Quarter		Whole Year	
	Large Section (150 students)	Small Section (12 students)	Large Section (145 students)	Small Section (8 students)	Large Section (115 students	Small Section (11 students)	Large Section (Average)	Small Section (Average)
Av. achievement score	75.7%	69.4%	67.5%	66.2%	75.0%	78.7%	72.7%	71.4%
Av. per-student cost of instruction	$4.34	$36.29	$2.83	$24.49	$5.19	$39.45	$4.12	$33.41

TABLE CLXX

SUMMARY OF RESULTS IN 18 CLASS-SIZE EXPERIMENTS IN SIX SEPARATE COURSES IN THE COLLEGE OF EDUCATION

Experiment No.	Course	Instructor	Quarter	Size of Classes L	Size of Classes S	Number of Pairs	Difference in Means of F.C.	Experimental Coefficient	Approximate Chance Value	Results in Favor Of
30a	High School Techniques	Mr. Hudelson	w	113	20	18	3.8	.3047	3.9 to 1	Large
30b	High School Techniques	Mr. Hudelson	w	113	20	16	2.5	.3441	3.9 to 1	Large
31	High School Techniques	Mr. Hudelson	s	100	26	21	3.9	.3658	3.9 to 1	Large
32	High School Techniques	Mr. Hudelson	w, f	108	18	17	4.3	.3492	3.9 to 1	Large
33	High School Techniques	Mr. Hudelson	f	57	18	16	5.5	.4385	6.5 to 1	Large
34	Educational Psychology	Mr. Miller	f, w	109	64	49	10.2	.83	75 to 1	Small
35	Educational Psychology	Mr. Miller	f	109	46	30	.66	.0416	Even	Small
36	Educational Psychology	Mr. Miller	f, w	133	81	65	1.3	.1156	1.6 to 1	Small
37	Educational Psychology	Mr. Miller	f	133	49	37	5.13	.3936	3.9 to 1	Large
38	Mental Testing	Mr. Miller	s, f	73	40	24	2.3	.1214	1.6 to 1	Small
39	Mental Testing	Mr. Miller	s, f	73	42	30	.2	.0118	Even	Large
40	Educational Sociology	Mr. Finney	f	169	56	38	3.8	.4857	6.5 to 1	Large
41	History of Education	Miss Alexander	f	104	79	49	4.12	.4462	6.5 to 1	Large
42	History of Education	Miss Alexander	s, w	123	75	58	4.724	.7438	38 to 1	Small
43	The High School	Mr. Troxel	s, w	77	49	47	7.2	.8031	75 to 1	Large
44	The High School	Mr. Koos	s, f	146	77	59	5.7	.7102	38 to 1	Large
45	The High School	Mr. Koos, Mr. Powers	f	81	35	25	17.24	1.258	2350 to 1	Large
46	The High School	Mr. Koos, Mr. Powers	s	146	49	40	1.575	.1641	1.6 to 1	Small
47	The High School	Mr. Koos, Mr. Powers	w	119	42	34	3.853	.4811	6.5 to 1	Large

The detailed distribution sheets for each criterion are on file in the library of the University of Minnesota.

Class-Size Experiments in the College of Education

Eighteen separate class-size experiments have to date been completed in the College of Education. They have involved six separate courses and entailed the cooperation of seven different instructors. An idea of the extent of this group of experiments can be gained from the general summary shown in Table CLXX. Making no allowance for duplicates, 2,086 students in large classes and 887 students in small sections are involved. Six hundred and seventy-three student pairs are compared.

Some of the experiments were more carefully controlled than others, the ones least controlled being Numbers 32, 34, 36, 38, 39, 41, 43, 44, 46, and 47. In these, either the quarter or the instructor was not always held constant; so any marked difference in results may be at least partially due to some factor other than mere size of class. In general, however, they agree with the more carefully controlled units.

Thirteen of the experiments resulted in favor of the large classes, while six were favorable to the small. Three of the five differences that may be called significant accrued to large classes, two to small.

Attention is called to the sizes of the so-called "small" classes. Compared to the average enrollment normally accommodated in these courses, these sizes represent relatively small groups; whereas, compared to the average of all University of Minnesota courses, these classes represent medium-sized or even large groups. Looked at, then, from an all-university point of view, these experiments resolve themselves into a test of medium-versus-large or large-versus-larger classes. This probably accounts for the inconsistency of results, although no distinct trend can be traced and the larger groups in general are still found to be superior. It was hoped that some light might be shed upon the question of optimum size; but no unequivocal evidence can be detected which would indicate that the optimum size has yet been determined.

TABLE CLXXI

SUMMARY OF EXPERIMENT No. 30a

1. Subject, Techniques of High School Instruction

2. Instructor, Mr. Earl Hudelson, Professor of Education

3. Sections

Sections	No.	Size	Quarter
a. Large	1	113	Winter, 1925
b. Small	2	20	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	93.6	13.49	3.32	.68	129.0	13.72
Small	92.0	18.25	3.36	.58	127.0	12.7

5. Number of pairs, 18

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.2	17.6	3.26	.47	129.1	12.2
Small	93.1	23.1	3.28	.49	125.3	14.6

7. Difference of the means in final criteria, 3.8

8. Difference is in favor of large group

9. Experimental coefficient, .3047

10. Approximate chance value is 3.9 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXII

SUMMARY OF EXPERIMENT NO. 31

1. Subject, Techniques of High School Instruction

2. Instructor, Mr. Hudelson

3. Sections

Sections	No.	Size	Quarter
a. Large	1	100	Spring, 1925
b. Small	2	26	Spring, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	96.2	10.87	3.27	.64	134.4	14.7
Small	91.7	12.72	3.14	.85	129.6	16.3

5. Number of pairs, 21

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.2	9.07	3.25	.83	134.1	13.3
Small	94.8	9.83	3.26	.80	130.2	11.5

7. Difference of the means in final criteria, 3.9

8. Difference is in favor of large group

9. Experimental coefficient, .3658

10. Approximate chance value is 3.9 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXIII

Summary of Experiment No. 33

1. Subject, Techniques of High School Instruction

2. Instructor, Mr. Hudelson

3. Sections

	No.	Size	Quarter
a. Large	1	57	Fall, 1926
b. Small	2	18	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller B		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	93.2	12.1	2.73	.67	123.7	14.4
Small	92.8	16.3	2.72	.81	123.3	17.4

5. Number of pairs, 16

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller B		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.1	10.1	2.53	.68	132.2	13.0
Small	95.3	9.8	2.50	.68	126.7	12.5

7. Difference of the means in final criteria, 5.5

8. Difference is in favor of large group

9. Experimental coefficient, .4385

10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXXIV

EXPERIMENT No. 30b

Comparison of the Per Cent of Gain in the Same Objective Examination Given on Both an Initial and a Final Test to Groups Paired on the Basis of Average Percentile Rank on Two Intelligence Tests and Also Average Honor Points, Selected from the Large and Small Sections in Techniques of High School Instruction, Winter Quarter, 1925

(Mr. Hudelson cooperating)

STUDENT No.	P.R. IN INTELLIGENCE	AVERAGE HONOR POINTS	SCORE IN INITIAL OBJECTIVE EXAMINATION	SCORE IN FINAL OBJECTIVE EXAMINATION	GAIN IN POINTS	PER CENT OF GAIN
Large Group						
42	63.6	2.25	122	141	19	15.5
52	87.3	2.18	116	153	37	31.9
103	70.6	1.73	108	134	26	24.1
38	61.6	1.68	92	165	73	79.3
96	31.3	1.67	94	128	34	36.2
4	53.3	1.62	109	140	31	28.4
57	56.6	1.35	99	123	24	24.2
74	46.3	1.31	118	157	39	33.0
72	34.0	1.31	90	118	28	31.1
35	84.3	1.00	115	147	32	27.8
54	49.6	1.00	92	129	37	40.2
75	40.3	.76	124	141	17	13.7
29	57.6	.75	107	130	23	21.5
90	58.6	.75	92	113	21	22.8
50	19.3	.80	108	138	30	27.8
65	46.3	.67	110	124	14	12.7
Averages	53.78	1.30	106	136.3	30.3	29.3
S.D.	17.6	.47	13.9	12.2	11.8	15.9
Small Group						
1	58.0	2.33	131	154	23	17.6
2	95.6	2.19	92	148	56	60.9
3	81.6	1.73	113	131	18	15.9
4	89.0	1.64	107	146	39	36.4
5	24.0	1.63	99	127	28	28.3
6	53.6	1.62	102	135	33	32.4
7	42.6	1.38	113	135	22	19.5
8	46.3	1.33	97	131	34	35.0
9	38.0	1.29	114	134	20	17.5
10	86.0	1.00	95	114	19	20.0
11	46.3	1.00	111	142	31	27.9
12	52.3	.81	121	138	17	14.0
13	41.0	.81	112	123	11	9.8
14	62.6	.76	100	119	19	19.0
15	14.3	.73	69	112	43	62.3
16	44.3	.62	106	119	13	12.3
Averages	54.7	1.30	105.1	131.7	26.6	26.8
S.D.	23.1	.49	11.2	14.6	13.2	14.8

TABLE CLXXV

SUMMARY OF EXPERIMENT No. 30b

1. Subject, Techniques of High School Instruction

2. Instructor, Mr. Hudelson

3. Sections

Sections	No.	Size	Quarter
a. Large	1	113	Winter, 1925
b. Small	2	20	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	48.8	25.8	1.30	.62	138.0	14.6
Small	51.5	24.4	1.40	.60	134.0	12.3

5. Number of pairs, 16

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Score	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	53.8	17.6	1.30	.47	136.3	12.2
Small	54.7	23.1	1.30	.49	131.7	14.6

7. Difference of the means in final criteria, 4.55, 2.5

8. Difference is in favor of large group

9. Experimental coefficient, .3441, .1656

10. Approximate chance value is 3.9 to 1, 1.6 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, F-minus 1.

TABLE CLXXVI

Summary of Experiment No. 32

1. Subject, Techniques of High School Instruction

2. Instructor, Mr. Hudelson

3. Sections

	No.	Size	Quarter
a. Large	1	108	Winter, 1927
b. Small	2	18	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller B		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	90.6	12.6	2.68	.71	121.4	14.6
Small	92.8	16.3	2.72	.81	123.3	17.4

5. Number of pairs, 17

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller B		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.8	10.1	2.64	.75	128.8	12.4
Small	95.2	10.1	2.64	.75	124.5	13.4

7. Difference of the means in final criteria, 4.3

8. Difference is in favor of large group

9. Experimental coefficient, .3492

10. Approximate chance value is 3.9 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXXVII

SUMMARY OF EXPERIMENT NO. 34

1. Subject, Educational Psychology

2. Instructor, Mr. Wilford S. Miller, Professor of Educational Psychology

3. Sections

Sections	No.	Size	Quarter
a. Large	1	109	Fall, 1922
b. Small	2	64	Winter, 1923

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.8	14.1	3.34	.70	111.0	22.5
Small	89.1	17.0	3.07	.70	115.0	23.7

5. Number of pairs, 49

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.5	10.8	3.27	.63	109.7	22.3
Small	94.2	11.9	3.27	.63	119.9	21.4

7. Difference of the means in final criteria, 10.2

8. Difference is in favor of small group

9. Experimental coefficient, .83

10. Approximate chance value is 75 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXVIII

Summary of Experiment No. 35

1. Subject, Educational Psychology

2. Instructor, Mr. Miller

3. Sections

	No.	Size	Quarter
a. Large	1	109	Fall, 1922
b. Small	3	46	Fall, 1922

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.9	14.1	3.30	.70	111.0	22.5
Small	98.3	9.8	3.50	.59	114.1	22.5

5. Number of pairs, 30

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	98.2	10.3	3.61	.52	112.7	22.8
Small	97.7	10.0	3.59	.53	113.3	21.4

7. Difference of the means in final criteria, .66

8. Difference is in favor of small group

9. Experimental coefficient, .0416

10. Approximate chance value is even

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXIX

SUMMARY OF EXPERIMENT NO. 36

1. Subject, Educational Psychology

2. Instructor, Mr. Miller

3. Sections

Sections	No.	Size	Quarter
a. Large	1	133	Fall, 1923
b. Small	2	81	Winter, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	93.2	11.7	3.30	.60	110.8	25.1
Small	92.7	13.3	3.22	.51	108.6	22.2

5. Number of pairs, 65

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.3	11.2	3.24	.54	107.9	23.2
Small	93.8	11.3	3.24	.53	109.2	22.9

7. Difference of the means in final criteria, 1.3

8. Difference is in favor of small group

9. Experimental coefficient, .1156

10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXX

SUMMARY OF EXPERIMENT NO. 37

1. Subject, Educational Psychology

2. Instructor, Mr. Miller

3. Sections

	No.	Size	Quarter
a. Large	1	133	Fall, 1923
b. Small	3	49	Fall, 1923

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	93.2	11.7	3.30	.60	110.3	25.1
Small	93.1	13.3	3.50	.70	117.1	20.9

5. Number of pairs, 37

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	92.5	14.4	3.40	.60	118.8	19.9
Small	92.5	13.5	3.40	.66	113.7	20.4

7. Difference of the means in final criteria, 5.13

8. Difference is in favor of large group

9. Experimental coefficient, .3936

10. Approximate chance value is 3.9 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXXI

SUMMARY OF EXPERIMENT NO. 38

1. Subject, Mental Testing

2. Instructor, Mr. Miller

3. Sections

Sections	No.	Size	Quarter
a. Large	1	73	Summer, 1923
b. Small	3	40	Fall, 1922

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Miller B		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.4	13.0	97.7	11.6	161.1	24.8
Small	98.4	15.9	97.0	11.9	168.0	17.9

5. Number of pairs, 24

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Miller B		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	98.3	11.4	99.3	8.7	168.3	22.5
Small	98.3	10.9	99.5	8.9	170.6	34.7

7. Difference of the means in final criteria, 2.3

8. Difference is in favor of small group

9. Experimental coefficient, .1214

10. Approximate chance value is 1.6 to 1

No Mark Points.

TABLE CLXXXII
SUMMARY OF EXPERIMENT NO. 39

1. Subject, Mental Testing

2. Instructor, Mr. Miller

3. Sections

Sections	No.	Size	Quarter
a. Large	1	73	Summer, 1923
b. Small	2	42	Fall, 1922

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Miller B		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.4	13.0	97.7	11.6	161.2	24.8
Small	96.5	12.7	96.2	10.9	162.5	26.2

5. Number of pairs, 30

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Miller B		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	98.2	11.0	97.5	9.4	161.0	24.7
Small	98.4	10.3	97.6	9.7	160.8	22.5

7. Difference of the means in final criteria, .2

8. Difference is in favor of large group

9. Experimental coefficient, .0118

10. Approximate chance value is even

No Mark Points.

TABLE CLXXXIII

SUMMARY OF EXPERIMENT NO. 40

1. Subject, Educational Sociology
2. Instructor, Mr. Ross L. Finney, Assistant Professor of Educational Sociology
3. Sections

Sections	No.	Size	Quarter
a. Large	1	169	Fall, 1926
b. Small	2	56	Fall, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R. in Miller B		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	52.0	28.1	2.87	.72	169.0	13.0
Small	53.7	29.6	2.60	.63	175.4	13.8

5. Number of pairs, 38
6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R. in Miller B		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	52.6	29.6	2.61	.57	176.6	13.8
Small	52.7	28.1	2.68	.61	172.8	11.2

7. Difference of the means in final criteria, 3.8
8. Difference is in favor of large group
9. Experimental coefficient, .4857
10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CLXXXIV

Summary of Experiment No. 41

1. Subject, History of Education

2. Instructor, Miss Jean H. Alexander, Instructor in Education

3. Sections

	No.	Size	Quarter
a. Large	1	104	Fall, 1925
b. Small	2	79	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	93.6	12.6	3.14	.62	111.2	16.8
Small	93.9	12.0	3.22	.76	109.1	20.5

5. Number of pairs, 49

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	96.0	8.0	3.24	.56	114.1	16.5
Small	96.0	8.2	3.24	.55	109.9	16.4

7. Difference of the means in final criteria, 4.12

8. Difference is in favor of large group

9. Experimental coefficient, .4462

10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXXV

SUMMARY OF EXPERIMENT No. 42

1. Subject, History of Education

2. Instructor, Miss Alexander

3. Sections

	No.	Size	Quarter
a. Large	1	123	Spring, 1925
b. Small	2	75	Winter, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.0	13.0	3.04	.69	107.7	12.0
Small	95.0	12.1	3.25	.54	113.4	12.0

5. Number of pairs, 58

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.8	10.3	3.25	.54	108.8	12.1
Small	96.8	9.9	3.25	.53	113.5	12.6

7. Difference of the means in final criteria, 4.724

8. Difference is in favor of small group

9. Experimental coefficient, .7438

10. Approximate chance value is 38 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXXVI

SUMMARY OF EXPERIMENT NO. 43

1. Subject, The High School
2. Instructor, Mr. Oliver L. Troxel, Assistant in Educational Administration
3. Sections

Sections	No.	Size	Quarter
a. Large	1	77	Spring, 1926
b. Small	2	49	Winter, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	102.4	15.7	3.29	.65	140.6	20.3
Small	90.9	15.0	3.11	.80	139.9	15.1

5. Number of pairs, 47
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.0	11.5	3.26	.58	148.4	13.8
Small	93.9	11.8	3.29	.60	141.2	13.7

7. Difference of the means in final criteria, 7.2
8. Difference is in favor of large group
9. Experimental coefficient, .8031
10. Approximate chance value is 75 to 1

Scale for Mark Points: A-5, B-4, C-3, D-2, E-1, F-0.

TABLE CLXXXVII

SUMMARY OF EXPERIMENT NO. 44

1. Subject, The High School
2. Instructor, Mr. Leonard V. Koos, Professor of Secondary Education
3. Sections

Sections	No.	Size	Quarter
a. Large	1	146	Spring, 1925
b. Small	2	77	Fall, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Average H.P.		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	94.6	12.2	1.34	.58	98.5	15.3
Small	91.0	15.1	1.38	.62	95.8	16.4

5. Number of pairs, 59
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Average H.P.		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	91.1	11.0	1.51	.53	101.5	15.2
Small	92.3	11.3	1.52	.53	95.8	16.4

7. Difference of the means in final criteria, 5.7
8. Difference is in favor of large group
9. Experimental coefficient, .7102
10. Approximate chance value is 38 to 1

Scales for Mark Points: A-3, B-2, C-1, D-0, F-minus 1.

TABLE CLXXXVIII

SUMMARY OF EXPERIMENT NO. 45

1. Subject, The High School

2. Instructors, Mr. Koos and Mr. J. Orin Powers, Instructor in Education

3. Sections

Sections	No.	Size	Quarter
a. Large	1	81	Fall, 1924
b. Small	2	35	Fall, 1923

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	90.5	16.8	1.58	.61	96.1	15.7
Small	87.8	14.9	1.59	.67	81.2	18.9

5. Number of pairs, 25

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	90.7	16.8	1.64	.61	98.4	15.7
Small	90.8	14.6	1.64	.60	81.1	19.0

7. Difference of the means in final criteria, 17.24

8. Difference is in favor of large group

9. Experimental coefficient, 1.258

10. Approximate chance value is 2350 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, F-minus 1.

TABLE CLXXXIX

SUMMARY OF EXPERIMENT NO. 46

1. Subject, The High School

2. Instructors, Mr. Koos and Mr. Powers

3. Sections

Sections	No.	Size	Quarter
a. Large	1	146	Spring, 1925
b. Small	2	49	Spring, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	95.1	12.1	1.34	.58	98.4	15.8
Small	87.0	12.2	1.27	.48	94.3	15.1

5. Number of pairs, 40

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	88.3	12.1	1.28	.47	93.5	15.8
Small	88.2	12.2	1.27	.47	95.1	15.1

7. Difference of the means in final criteria, 1.575

8. Difference is in favor of small group

9. Experimental coefficient, .1641

10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXC

Summary of Experiment No. 47

1. Subject, The High School

2. Instructors, Mr. Koos and Mr. Powers

3. Sections

	No.	Size	Quarter
a. Large	1	119	Winter, 1925
b. Small	2	42	Winter, 1924

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	96.6	12.5	1.42	.55	98.1	14.4
Small	102.2	6.5	1.78	.35	100.1	12.6

5. Number of pairs, 34

6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	101.7	7.1	1.74	.35	103.6	12.4
Small	101.3	6.5	1.75	.35	99.7	11.3

7. Difference of the means in final criteria, 3.853

8. Difference is in favor of large group

9. Experimental coefficient, .4811

10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, F-minus 1.

TABLE CXCI

Summary of Results in Five Class-Size Experiments in Three Separate Departments in Two Separate Colleges

Experiment No.	Course	Instructor	Quarter	Size of Classes		No. of Pairs	Difference in Means of F.C.	Experimental Coefficient	Approximate Chance Value	Results in Favor Of
				L	S					
50	American History	Mr. Stephenson	f	107	40	20	.25	.079	Even	Large
51	American History	Mr. Stephenson	f	107	36	25	.12	.179	1.6 to 1	Large
52	Introductory Sociology	Mr. Mehus	s	37	20	17	6.4	.4537	6.5 to 1	Large
53	Mechanism of Exchange	Mr. Runser	s	67	28	20	.52	.12	1.6 to 1	Large
54	Mechanism of Exchange	Mr. Runser	s	39	28	16	1.47	.4951	6.5 to 1	Large

The results of the Education experiments are shown in Tables CLXXI to CXC. The matched groups and the group distributions for each criterion in these, as in all other experiments, are on file in the library of the University of Minnesota.

An interesting variation to the usual experimental procedure is illustrated by Experiments No. 30a, 30b, 31, and 33, all involving Professor Hudelson's course on Techniques of High School Instruction. Since the major aim in these experimental units was to determine the effect of various instructional techniques upon both large and small classes, the detailed account of the studies is reserved for Chapter VIII. Readers will, however, be referred to the pertinent tables in the present chapter.

Other Class-Size Experiments

To date, experiments have been completed in three other courses—Mechanism of Exchange, Introductory Sociology, and American History. The general results are portrayed in Table CXCI. All are in favor of the larger classes, although in no case is the difference of the means of the F.C. a decided one.

Mechanism of Exchange is a five-credit course offered to pre-business freshmen and majors in Economics in the School of Business. All students meet together twice a week for lectures. On three days a week they meet in small quiz and recitation sections. It is these that were involved in the experiment. The results are shown in Tables CXCII and CXCIII. The final criterion was the average of all test marks, including weekly quizzes and final examination. The weights used were: A=1, A— =2, B+ =3, B=4, B— =5, C+ =6, C=7, C— =8, D+ =9, D=10, D— =11, E=12, and F=13.

Despite the fact that the general intelligence of the small group in Experiment No. 53 (Table CXCII) was distinctly superior to that of the large group, the advantage to the paired students accrued to those in the large section.

The experiment in Introduction to Sociology was carried out by Mr. O. M. Mehus. This is a three-credit course open to all students above the second quarter of the freshman year. The classes numbered 37 and 20 students; hence the experiment may perhaps best be called a comparison of small and medium-sized classes rather than small and large. The results, which are in favor of the larger section, are given in Table CXCIV.

TABLE CXCII

Summary of Experiment No. 53

1. Subject, Mechanism of Exchange
2. Instructor, Mr. James A. Runser, Instructor in Accounting
3. Sections

Sections	No.	Size	Quarter
a. Large	1	67	Spring, 1925
b. Small	3	28	Spring, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	78.3	17.3	.76	.77	6.6	1.7
Small	91.4	13.7	.93	.70	6.1	1.6

5. Number of pairs, 20
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	87.6	14.3	.87	.73	5.4	1.6
Small	88.0	13.4	.87	.75	6.0	1.4

7. Difference of the means in final criteria, .52
8. Difference is in favor of large group
9. Experimental coefficient, .12
10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, E-minus 1, F-minus 2.

Weights for F.C.: A 1, B 4, C 7, D 10, E 12, A— 2, B— 5, C— 8, D— 11, F 13, B+ 3, C+ 6, D+ 9.

TABLE CXCIII

SUMMARY OF EXPERIMENT No. 54

1. Subject, Mechanism of Exchange
2. Instructor, Mr. Runser
3. Sections

Sections	No.	Size	Quarter
a. Large	2	39	Spring, 1925
b. Small	3	28	Spring, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 Miller A		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	91.6	13.5	.92	.72	5.2	1.65
Small	91.4	13.7	1.08	.84	6.06	1.53

5. Number of pairs, 16
6. Central tendency and variability of the paired groups

	(d) P.F. 1 Miller A		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	91.1	13.4	.91	.59	5.41	1.54
Small	91.1	12.6	.90	.59	6.88	1.26

7. Difference of the means in final criteria, 1.47
8. Difference is in favor of large group
9. Experimental coefficient, .4951
10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-3, B-2, C-1, D-0, E-minus 1, F-minus 2.

Weights for F.C.: A 1, B 4, C 7, D 10, E 12, A— 2, B— 5, C— 8, D— 11, F 13, B+ 3, C+ 6, D+ 9.

TABLE CXCIV

SUMMARY OF EXPERIMENT NO. 52

1. Subject, Introduction to Sociology
2. Instructor, Mr. Oscar M. Mehus, Teaching Assistant in Sociology
3. Sections

Sections	No.	Size	Quarter
a. Large	1	37	Spring, 1925
b. Small	2	20	Spring, 1926

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	49.9	28.1	3.25	.72	114.7	11.6
Small	52.5	31.6	3.36	.99	112.5	15.4

5. Number of pairs, 17
6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Objective	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	49.8	32.4	3.29	.88	116.0	13.8
Small	50.3	31.5	3.29	.96	109.6	15.8

7. Difference of the means in final criteria, 6.4
8. Difference is in favor of large group
9. Experimental coefficient, .4537
10. Approximate chance value is 6.5 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXCV

Summary of Experiment No. 50

1. Subject, American History

2. Instructor, Mr. George M. Stephenson, Assistant Professor of History

3. Sections

Sections	No.	Size	Quarter
a. Large	2	107	Fall, 1926
b. Small	1	40	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	50.4	27.8	3.00	.88	2.9	1.0
Small	45.4	31.2	2.89	.78	3.0	1.3

5. Number of pairs, 20

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	49.6	30.3	2.65	.68	2.7	.8
Small	49.2	29.7	2.64	.73	2.9	1.4

7. Difference of the means in final criteria, .25

8. Difference is in favor of large group

9. Experimental coefficient, .079

10. Approximate chance value is even

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

TABLE CXCVI

SUMMARY OF EXPERIMENT No. 51

1. Subject, American History

2. Instructor, Mr. Stephenson

3. Sections

Sections	No.	Size	Quarter
a. Large	2	107	Fall, 1926
b. Small	3	36	Fall, 1925

4. Central tendency and variability of entire groups

	(a) P.F. 1 P.R.		(b) P.F. 2 Mark Points		(c) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	50.4	37.8	3.00	.88	2.9	1.00
Small	57.1	20.4	3.16	.71	3.1	1.2

5. Number of pairs, 25

6. Central tendency and variability of the paired groups

	(d) P.F. 1 P.R.		(e) P.F. 2 Mark Points		(f) F.C. Final Mark	
	M.	S.D.	M.	S.D.	M.	S.D.
Large	56.0	21.5	2.92	.52	2.7	.5
Small	55.9	21.2	2.92	.47	2.8	1.1

7. Difference of the means in final criteria, .12

8. Difference is in favor of large group

9. Experimental coefficient, .1794

10. Approximate chance value is 1.6 to 1

Scale for Mark Points: A-1, B-2, C-3, D-4, E-5, F-6.

The latest experiments reported were carried on in connection with the course in American History. In the fall of 1926 the small sections theretofore customary in this course were abandoned, the students being all instructed in two large lecture groups. The study reported compares the achievement of one of the large lecture groups, taught by Professor Stephenson during the fall quarter of 1926, with two small sections taught by him during the fall of 1925. The comparisons, as revealed in Tables CXCV and CXCVI, are both adverse to the small classes.

TABLE CXCVII

Comparison of Average Scores on Final Objective Examination Made by Paired Students in the Large Sections and in the Small Sections of 20 Classes in General Psychology, 1925-26, Students Classified According to Percentile Ranks in Intelligence

Percentile Ranks in Intelligence	Number of Cases	Average Objective Score of Paired Students From		Per Cent of Difference in Objective Score
		Large Section	Small Section	
90-100	38	117.81	111.63	5.5
80	29	107.17	104.37	2.7
70	22	104.04	87.31	15.9
60	19	99.47	88.89	11.9
50	15	106.60	92.26	15.5
40	24	88.29	85.66	3.1
30	13	99.50	86.34	15.2
20	11	92.27	85.81	19.2
10	18	92.61	80.44	15.1
0-9	4	80.50	62.00	29.8

Other Considerations

Achievement by Intelligence Levels.—The majority of the students who replied to the questionnaire (see Chapter V) believed that large classes favor superior students and that small classes favor dull students. In general the faculty concurred in both opinions (see Chapter VI).

Our experimental material furnishes some quantitative data bearing on this point. There were twenty classes in General Psychology in which the facts concerning intelligence and scholarship were derived in a uniform manner. Since the paired students in

the large groups were carefully matched with those in the small, a comparison of the relative achievement of these paired students should provide at least a partial answer to this aspect of the general problem.

Accordingly the matched students in each type of class, large and small, were arranged in groups according to the decile divisions of percentile ranks in intelligence. Of the total number of pairs, 193 were found in which there was no overlapping in decile groups. These cases were distributed as shown in Table CXCVII. At each P.R. level the average score on the objective final examination in General Psychology was calculated separately for the paired students in both the large and small sections. These averages are arrayed in columns 3 and 4 of Table CXCVII. At every level of intelligence the matched members, superior as well as inferior, in the large classes exceed those in the small. Apparently neither the better nor the poorer students have been handicapped by being assigned to large sections of this particular course.

TABLE CXCVIII

Comparison of Average Scores on Final Objective Examination Made by Paired Students in the Large Sections and in the Small Sections of General Psychology, 1925-26, Classified According to Mark Points

Average Mark Points	Number of Casts	Average Objective Score of Paired Students From		Per Cent of Difference in Objective Score
		Large Section	Small Section	
1-1.9	17	131.52	118.76	10.3
2-2.9	63	108.85	98.88	10.1
3-3.9	68	91.23	85.94	6.2
4-4.9	9	80.33	76.55	4.9
5-5.9	1	63.00	38.00	65.8

But have the superior students been especially favored? The relative amount by which the paired student in the large section surpasses his mate in the small class at each level is revealed in the last column of the table. There is little evidence of any definite trend. Outside of the groups at the extreme, where the figures favor the superior students, the relative gain is no greater for the higher levels of intelligence than for the lower.

Outside of the extreme groups it will be noted that there is an apparent lack of close relationship between intelligence and achievement on the objective examinations. This is unmistakable warning of the danger of accepting a single record of intelligence as the only pairing factor in a study of this kind.

Achievement by Mark-Point Levels.—Ignoring intelligence, do students of proven superior scholarship achieve better in large classes or in small ones? Are students of inferior scholarship really handicapped by large classes? The answers are suggested in Table CXCVIII.

All paired students in the same classes in General Psychology that were used in the previous comparison were reclassified according to average honor points earned during their freshman year. In the five mark-point rubrics 158 pairs were found in which there was a clear division with no overlapping. At every scholarship level the paired students in the large classes achieved better than did their mates in the small classes. On the basis of this evidence the conclusion again follows that neither the superior nor the inferior student is handicapped by large sections. The percentage trend in the last column suggests that although both types of students do better in large groups than in small, the excellent scholar profits more from large classes.

TABLE CXCIX

Comparison of Average Scores on Final Objective Examination, Made by Paired Students, Classified According to Superior and Inferior Students

Range For		Number of Cases	Average Objective Score of Paired Students From		Per Cent of Difference in Objective Score
Percentile Ranks	Mark Points		Large Section	Small Section	
Above 75 (P.R.)	Below 2.50 (M.P.)	27	124.81	115.40	8.2
Below 40 (P.R.)	Above 3.50 (M.P.)	16	84.56	78.50	7.7

Relative Achievement of Superior and Inferior Students.—To provide a more satisfactory indication of the significance of this question, Table CXCIX is offered. In this table a superior student

is not only in the upper quartile of intelligence as evidenced by percentile ranks, but he has also earned an average of not more than 2.5 mark points. An inferior student is below 40 P.R. and has earned an average of more than 3.5 mark points. Due to the variance between levels of individual cases in intelligence and in scholarship, out of the group previously considered only 27 superior and 16 inferior students could be isolated. According to these data, both superior and inferior students do markedly better in large classes. The difference in per cents is almost identical for both groups, indicating that neither is particularly favored by large classes nor handicapped by small ones.

These data are too limited to warrant sweeping conclusions. They do, however, furnish some support for the belief that, in this course at least, size of class is a very minor factor in the relative achievement of superior and inferior students. Furthermore, large classes appear to stimulate both levels to higher attainment.

Summary

Semicontrolled studies of the relation of class size to student marks had indicated that there is little or no difference in the effectiveness of large and small classes. The fact that the marks in some cases were based upon subjective criteria and in others upon objective tests did not materially affect the findings.

This tentative conclusion has been completely supported by fifty-nine fully or semicontrolled experiments involving 108 classes under twenty-one instructors in eleven departments in four colleges of the University of Minnesota. The experiments involved 6,059 students—4,205 in large classes and 1,854 in small. Direct man-to-man comparisons were made upon 1,288 pairs of students, carefully matched as to intelligence and scholarship. The final criterion was student achievement as measured by tests and examinations, most of which were objective.

In forty-six of the experiments, or 78 per cent, a more or less decided advantage accrued to the paired students in the large sections. Only in the remaining thirteen, or 22 per cent, was there any advantage in favor of the smaller classes. At every intelligence level the paired students in the large sections excelled their mates in the small. Except at the very extreme, where results

favored the superior students, the relative gain in achievement was no greater for the higher levels of intelligence than for the lower. It would seem that except in the case of a few exceptionally capable and zealous students there is considerable waste of intelligence in both large and small classes. At every scholarship level the paired students in the large sections outstripped their mates in the small. The excellent scholars profited somewhat more from large classes than did their less conspicuous classmates. Large classes seem to have spurred every type of student to higher levels of attainment.

Conclusions

Since small classes, other things being equal, greatly increase the cost of instruction, they must be justified on other grounds. In the light of the consistent results of this investigation, it would seem that it will be extremely difficult to justify them on the ground of superior student achievement.

CHAPTER VIII

CLASS SIZE AND TECHNIQUES OF INSTRUCTION

The ultimate question involved in the problem of class size is not which size is best under present circumstances, but whether or not conditions and procedures can be so modified as to justify the organization or continuance of large classes. Prominent among the factors that are popularly believed to influence educational efficiency is instructional technique. Any exhaustive investigation of class size, then, must consider the effect of various teaching procedures upon classes of various sizes and determine experimentally the size with which each procedure is most effective. Optimum class size, in other words, can be determined only after every reasonable effort has been made to adapt instruction to the size of the class.

Experiments in Education 15

While more or less consideration of teaching methods is unavoidable in any experiment on class size, in only two courses during the present investigation has this factor been carefully controlled. In his course Techniques of High School Instruction (Education 15) Professor Hudelson carried on a series of controlled experiments aimed not only to study relative student achievement in large and small classes, but to determine the effect of various instructional procedures upon both large and small classes.

Education 15 was at the time a required one-quarter teacher-training course. It is usually taken late in the junior or early in the senior year. The membership is quite homogeneous and the central tendency in intelligence and scholarship varies little from quarter to quarter. The interests of the students are similar and their previous training has been much the same. The course is an established one and is carefully outlined, mimeographed syllabi and reading lists being extensively used.

During the winter quarter of 1924-25 there was one section of 20 and another of 113 students. In both classes the question-and-answer method was used *exclusively*. Every other factor was as carefully controlled as possible. As will be seen in Table CLXXI,

Experiment 30a (Chapter VII), the paired students in the large section achieved better than the members of the small class did, although the difference was not pronounced.

In the spring quarter of the same year the students were divided into classes of 26 and 100. This time the lecture method was employed *exclusively,* all other factors being controlled as carefully as possible. Again (Table CLXXII, Experiment 31, Chapter VII) the results favored the large group, although, as before, the difference was not significant.

In the above two experimental units all four sections kept within a margin of nine points on the same comprehensive objective final examination. This suggests that the variation in teaching technique affected the results very little if at all.

In the fall quarter of 1926-27 the class was divided into sections of 18 and 57. During the first five meetings Professor Hudelson demonstrated before each section his ability to use the various conventional teaching methods. He then allowed each class to choose which procedure or combination of procedures it desired to have him use during the rest of the quarter. The large group voted for a diversified method. The smaller section chose an informal discussion technique in which all students sat in a circle and participated at will. The instructor, effacing his official capacity as completely as possible, was only a member of the circle.

The comparative results are shown in Table CLXXIII, Experiment 33, Chapter VII. In spite of the maximum opportunity allowed the smaller group for student participation, class discussion, and intimate contacts with each other and with the instructor, the paired students in the large class achieved superior results. The central tendencies of all members of the two groups (paired and unpaired) were practically identical. The instructor found the large class much more inspiring, but at the end of the year was able with more discrimination to recommend the members of the small class for positions because he was better acquainted with them.

While much more corroborating evidence is needed before definite conclusions can be safely drawn, the results of these three experiments suggest that technique of instruction may have less influence upon student achievement than is generally ascribed to it. There is also an intimation that the value of student participation may be overrated.

During the winter quarter of 1925 a variation was employed in this same course as a check upon both technique and class size. Professor Hudelson has for several years used the same comprehensive objective final examination. During this quarter he administered this examination to both his small (20 students) and large (113 students) classes during the first two days as a preliminary test. The same examination was repeated at the end of the course. Students in the large and small sections were carefully matched on the bases of intelligence and scholarship and also by the additional criterion of their scores on the initial examination. The pairing data are displayed in Table CLXXIV, Chapter VII.

The average gain in total points made by each group was computed, as well as the average per cent of gain. The large class made an average gain of 30.3 points, while the small section gained but 26.6 points. The average per cent of gain in the large class (paired students only) was 29.3 as against 26.8 in the small group. The experimental coefficient of this gain is .1656 and the approximate chance value is 1.6 to 1; hence the difference is not very significant. The summary is presented in Table CLXXV, Experiment 30b, Chapter VII. See also Table CC.

TABLE CC

Comparative Results of Class Size in Ed. 15 f and w (1924-25)

I. Average amount of gain between initial and final scores on same test:	
A. Fall-quarter class (single section)	32.88
B. Winter-quarter classes (both sections)	28.64
(1) Small section	26.60
(2) Large section (paired and unpaired)	29.00
(3) Paired students only	
(a) Small section	26.60
(b) Large section	30.30
II. Average per cent of gain between initial and final scores on same test:	
A. Fall-quarter class (single section)	36.90
B. Winter-quarter classes (both sections)	33.34
(1) Small section	26.17
(2) Large section	34.75
(3) Paired students only	
(a) Small section	26.80
(b) Large section	29.30

Experiments in Physics

In the fall of 1926 the Department of Physics launched a two-year series of experiments with large and small classes to test the relative efficiency of its old and new types of class organization and instruction. Data on the fall- and winter-quarter experimental units are available. Since the occasion, the situation, the experimental technique, and the class-size results have already been reviewed in Chapter VII, the treatment will here be confined to a discussion of the relation of instructional technique to class size. Readers will be referred to the tables in Chapter VII to avoid repetition. The present discussion is adapted from the progress reports of Professors Erikson and Buchta.

Fall-Quarter Unit

The initial experiment involved two carefully paired groups of twelve students each. One of these groups was placed with 138 other students in a second-hour section of 150. The other group of twelve was put in a section by itself at the third hour. Both experimental sections met in the same room, namely the physics lecture room, in charge of Professor Erikson. The same text and text assignments were used in both groups. All wrote on the same weekly quizzes and final examination in the same room at the same hour. All papers were judged by the same readers under a plan of rotation that offset, to some degree at least, possible inequalities among scorers.

The instructor kept himself in ignorance as to the grades obtained by the two groups as the quarter progressed so as to avoid any forced equalization. In the large group the period was devoted to explanations and demonstrations by the instructor on the points in the assignment for the day. No oral quizzing was resorted to. Questions at any time were solicited but not many were asked. In the small group the same procedure in the main was followed, except that it was less formal. More questions were asked by and of the students. In other words, an attempt was made to get closer together; otherwise no coercive methods were employed.

In Table CLXV, Chapter VII, will be found data concerning the paired students in the two groups. Table CLXVI gives the

average scores of all fall-quarter Physics students, of several control sections, of all students (paired and unpaired) in the large experimental class, and of the paired students in the large and the small experimental groups. It will be observed that the paired students in the large experimental section not only surpassed in achievement their mates in the small experimental section, but excelled somewhat all other Physics classes that quarter.

Undue significance should not, of course, be attached to the results of a single unit. This is only one-sixth of the entire experiment contemplated. A comparable unit is now [March, 1927] in progress under Professor Buchta, who is experimenting with other adaptations of instructional technique to class size. During the spring quarter a third experimental project will be undertaken by Professor Erikson. During the three quarters of 1927-28 the plan is to carry on in the same manner, endeavoring by the process of trial and elimination to determine optimum techniques for classes of various sizes. The cumulative results should have considerable significance.[1]

It may be of value to record the impressions of the instructor. During the fall-quarter experiment a special effort was made to be as inspirational before the small group as before the large. It was found that this required greater effort in the case of the small class. This was due not to fatigue but rather to the stimulus of numbers.

It is not, of course, possible to compare objectively the degrees of interest shown by the two groups. As a whole the larger class impressed the instructor more. In the small section he noticed the tendency and danger of having the time usurped by the less well prepared, the instructor being called upon to explain points which to the majority were obvious. This of course requires vigilance on the part of the instructor.

The sessions of the smaller group did offer greater opportunity as a whole to the students. The instructor did not, however, note any special tendency on the part of the good student to avail himself of the opportunity. This may have been due to a desire on his part to do his own thinking, to the availability and accessibility of the needed material, or to indifference. On the whole, one is

[1] See discussion and footnote on p. 224.

impressed by the degree to which this matter resolves itself into a question of coercion. In the larger group the coercive measures were the weekly quizzes and the final examination. These, however, are, from the standpoint of the teacher, impersonal influences. Aside from them the student was on his own initiative. Since the personal element is remote in large classes, the desire on the part of the student to acquire becomes more the dominating factor.

Winter-Quarter Unit

The experimental sections for the winter-quarter (Physics 3w) project were chosen in the same manner as those in the fall-quarter unit. Table CLXVIII, Experiment No. 49, Chapter VII, analyzes the personnel of the two groups. The final averages and the individual comparisons imply that under the instructional procedures employed in this experiment, the size of the class had very little influence upon student achievement.

Professor Buchta's observations follow:

My own general impression is that for weaker students the small class with its possibility for more and repeated discussion has some advantages; but in most cases the differences in the grades of large- and small-class students can be attributed to other causes.

I admit that the results are different than I expected when the classes were started. I had hoped that by sending the students to the blackboard, asking more individual questions than are possible in a large class, and in general using what might be called small-class methods, superior results would be obtained from the smaller group. These procedures, however, slowed up the work a great deal and had to be partially abandoned in order to keep the two classes together. The pace in the small section was set more by the weaker members, and I felt that some of the time of the better students was wasted in going over work for those who asked that it be repeated.

In the large class the student did not depend so much upon me. If I gave a demonstration which he failed to understand his only recourse was to work it out for himself or to see me outside of class. In the small section I was called upon to explain the point again, which I did as far as I felt it justifiable. Doing so, however, meant that time was taken from some other work, since *the total amount of work covered was determined by the pace of the large class* [italics are ours]. It may be that in a class where the amount of work to be done is not so definitely prescribed or where it can be done more leisurely than in Physics 3, a small class would show more advantages.

Summary

No exhaustive investigation of the relation of instructional techniques to class size at the university level has yet been made. Every controlled attempt at the University of Minnesota to adapt instruction to the size of the class has resulted in superior achievement from the larger sections. Such modifications in teaching methods as have been tried have failed to affect achievement significantly in either the large or the small classes.

However anomalous it may sound, it seems to be true in the experiments thus far completed that the better opportunity for teacher-student contact in small classes retards progress. The students, particularly the weaker ones, in the small sections tend to lean too heavily upon their instructors instead of trying to dig things out for themselves. There is a suggestion that some of their trouble may arise from poor attention due to a belief that if they miss the point the first time the instructor will repeat it upon request. The more impersonal relationship between students and instructor in large classes would naturally discourage such a habit. At any rate, the large classes set the pace.

The results of the series of experiments in Education 15, in which exclusive techniques of teaching were varied while all other factors were kept as constant as possible, suggest that instructional procedures in either large or small classes may not be as influential as is commonly supposed and that the value of student participation may be overrated.

The variations in teaching methods in the controlled experiments in Physics under two different instructors failed to affect the superior results achieved by the larger classes.

CHAPTER IX

OBSERVED EVIDENCE

Preliminary visitations quickly convinced the subcommittee that there is a vast amount of excellent teaching going on in the University of Minnesota. It is regrettable that every instructor cannot have the opportunity to see it; for, however expert he himself may be, he could probably pick up many valuable suggestions. It is equally regrettable that the subcommittee was not able to take advantage of all of its invitations to visit large classes. Observation is time-consuming. Moreover, it requires the services of several persons because standards for evaluating instruction are as yet highly subjective. Nevertheless, several invaluable suggestions were gleaned from the large classes that were visited.

The observations were limited to large sections in basic science courses. This was due partly to the cordial invitations extended by the instructors of those courses and partly to the fact that science is popularly thought to be peculiarly unadaptable to large-class instruction. With the limited time at their disposal, the visitors desired to observe large classes under supposedly the worst conditions, thereby giving them the acid test. Their experiences have convinced the subcommittee that thoughtful planning will suggest many ways of overcoming the disadvantages of large classes in any department or course. Some of the measures resorted to in the science classes that were visited could undoubtedly be adapted with profit to large classes in other fields.

In the courses observed the students assembled in large groups for lectures. From 150 to 250 were addressed at a time. Mimeographed outlines of each lecture were distributed at the beginning of the hour. These contained all new technical terms and automatically helped the listeners to organize their notes and to label their sketches.

The lecturer stood on a raised platform in front of a large blackboard on which he sketched pictures or diagrams illustrating his lecture. He used only those crayon colors which are known to have the highest visibility. Instead of minute lettering, arrows were drawn to the area under discussion and the labels written or

printed large at the edge of the blackboard. The subcommittee members, who purposely sat in far corners of the room, could follow the drawings with ease. They were convinced that in such courses as these the privilege of seeing the drawings actually take shape had a distinct psychological value to the students. Sometimes, however, when the picture was especially complicated or when quantitative data were being presented, previously prepared wall-charts or lantern-slides were exhibited. Always before a sketch was erased or a chart removed the students were given an opportunity to raise questions.

The lecture-rooms were amphitheatric in construction, thereby insuring visibility and audibility on the part of both student and instructor and reducing the hazards of discipline in large classes. The visiting committeemen regularly questioned several students in various parts of the room and found that they had seen and heard without difficulty. The conviction grew that the splendid discipline, the serious attention, and the spirit of industry that consistently pervaded the lecture-rooms were due in no small part to the fact that everything was adapted to the size of the class.

The lectures usually occurred early in the morning. As soon thereafter as their schedules would permit the students repaired to the laboratories. There they found drawings, models, and actual specimens of the subjects that had just been discussed in the lecture. Pertinent charts hung on the walls and sometimes sketches similar to those drawn by the lecturer were reproduced on the laboratory blackboards. Two or three laboratory assistants were always at hand for consultation and guidance. The laboratory rooms, which sometimes accommodated as many as sixty students, were open throughout the day, and students could remain as long and return as often as they wished. When one unit of the course was mastered, the laboratory would be set for the next unit. This was done in the evenings by laboratory assistants.

The lectures were logically organized; the laboratories logically unorganized. The latter were arranged not to indulge the pride of the finished scientist but to satisfy the needs of the learning student. A few examples of each specimen were displayed. Each student could center his attention upon whatever was not clear

to him. He would observe the sample, handle it,[1] compare his notebook sketch with it, and revise his notes on it. Frequently two or three students with a common problem would hold council over a specimen. Usually they submitted their tentative conclusions to a laboratory assistant for verification or correction before entering them in final form in their notebooks. Each student might work alone or he might join several small groups in the course of a day. In short, the layout represented a nice adjustment between flexibility and economy. The keynote was self-education under expert guidance. The arrangement refuted the popular belief that large classes can be managed only at the sacrifice of the individual student.

Most assuredly the instructional procedure in each course depends primarily upon the aims and nature of the course; nevertheless many of the aims are common to all courses, and to this extent the best techniques in one department can often be adapted to other situations.

[1] The visitors were impressed with the importance to these prospective doctors, surgeons, chemists, botanists, zoologists, engineers, etc., of tactual impressions at the learning stage.

CHAPTER X

CLASS SIZE AND INSTRUCTIONAL COST

Never is the principle that educational efficiency is a relative, not an absolute, matter more pertinent than in a consideration of educational cost. The universal situation is that a school has just so much money to spend. No progressive institution has as much as it could profitably use. How, then, can it, with inadequate funds, most nearly realize all of its aims? Should it abandon its efforts to realize certain of them in order to attain perfection in the rest, or should it reconcile itself to a little less than perfection in order to render wider service?

Small classes, whether preferable or not, inevitably cost more than large ones. Chicago, for example, could save nearly ten million dollars by increasing the average size of its elementary school classes by two more students per class. The proportional saving in a university would be even greater. Assuming that small classes produce better immediate and direct results, are they enough better to justify the difference in cost? Keeping in mind the many other worthy services that could be rendered with the money saved, how much higher than students in large classes should students in small classes achieve to warrant the difference in instructional expense? This is one of the issues that make educational efficiency a relative matter.

Thus far the problem of comparative costs in large and small classes in the University of Minnesota has been analytically studied in only one department. In connection with their controlled experiments in Physics,[1] Professors Erikson and Buchta computed the relative costs of classes of 12, 145, and 150 students. It should be recalled that in both experiments the large sections excelled the small in achievement.

If the small classes had excelled the large in achievement the question would arise, did the difference in results justify the greater cost of the small classes? Since the large classes excelled in both experiments, the question smacks of impertinence.

[1] See Chapters VII and VIII for an account of these experiments.

The comparative instructional costs in Professor Erikson's fall-quarter experiment were as follows:

	In group of 150	In group of 12
Pro-rata instructor	$2.77	$34.70
For reading papers	1.00	1.00
For proctoring	.57	.57
Total	$4.34	$36.27

Comparative cost=36.27÷4.34=8.35 to 1.

The instructional cost for all of the 336 students in the course (experimental and nonexperimental sections) was as follows:

Pro-rata instructor	$ 916.80
For reading papers	338.61
For proctoring	192.00
Total	$1,447.41

Cost per student=$1,447÷336=$4.30

If these 336 students had all been organized into groups of 20, the cost would have been as follows:

Instructor cost per section	$ 229.20
Number of sections=336÷20=16.8	
Instructor cost for all sections	$3,850.56
For reading papers	388.61
For proctoring examinations	192.00
Total	$4,431.17

Cost per student=$4,431.17÷336=$13.21

Comparative cost=13.20÷4.30=3.07 to 1

Comparative costs in Professor Buchta's winter-quarter experiment in the same course were:

	In group of 145	In group of 12
Pro-rata instructor	$1.26	$15.27
For reading papers	1.00	1.00
For proctoring	.57	.57
Total	$2.83	$16.84

Comparative cost per student=16.87÷2.83=5.96 to 1

CHAPTER XI

CONCLUSIONS

In the light of all available evidence, class size seems to be a relatively minor factor in educational efficiency, measured in terms of student achievement. What the major factors are we do not know; to be determined they must be isolated, controlled, and tested one at a time. Nor do we know whether there are important educational outcomes other than achievement accruing, or at least accruable, only from small classes, or whether experiments by other instructors using the same or different teaching methods in the same or other departments or courses would produce similar results. All that can be said is that in the courses investigated, the effect of class size upon student achievement is, in the opinion of the subcommittee, too slight to warrant the cost of small classes.

It hardly seems reasonable that the same techniques of instruction are equally suitable to all sizes of classes; yet few efforts have been made studiously to adapt teaching methods to class size. Conclusions, therefore, are in the main based upon a comparison of traditional small-class methods versus slightly modified small-class methods. It may be that efficiency of instruction in small classes is now far below the maximum and that attention to technique could push the level of effectiveness above the maximum for large classes. What may be needed is a complete breaking away from tradition and the devising of instructional methods suited to the demands of modern higher education. The general coercive policies that prevail in colleges and universities may actually be doing injustice in the name of education.

Changes in class-size policy, however desirable, are certain to be of such import and to involve so many other educational factors that they should not be precipitously adopted, irrationally resisted, nor complacently ignored. They should, rather, be prepared for; for the necessary adaptations in budgeting, organization, buildings, curriculum, and instructional procedures cannot be effected overnight.

Every teacher is morally obligated to contribute his part to educational efficiency. If he can teach, or learn to teach, larger

classes with little or no loss of effectiveness to his students, neither prejudice, preference, nor tradition should deter him from contributing that much to educational economy; but if after a thorough, thoughtful, sincere trial he finds that he cannot, no amount of pressure should induce him to continue the attempt. He should, instead, contribute his part in other ways; for educational efficiency consists in each one's doing to his utmost what *he* can do best.

This investigation of class size is by no means exhaustive. Some of the issues involved have barely been raised and others have not even been broached. Before any of them can be definitely settled much long-continued and carefully controlled experimentation will be necessary. It is to be hoped that the present study may serve as a point of departure for such eminently worth-while research.

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APPENDIXES

APPENDIX A

A SUGGESTED TECHNIQUE FOR EXPERIMENTATION ON THE RELATION OF CLASS SIZE TO EDUCATIONAL EFFICIENCY AT THE UNIVERSITY LEVEL

I. Essential Considerations

A. COURSE

1. There should be at least two sections in the same course, a large and a small.
2. The course should be a well-established one, not a new one undergoing significant modifications.
3. Both sections should cover the same content within the outline of the course.

B. STUDENTS

1. The enrollment must be large enough to permit of careful pairing on as many as possible of the following bases. (That is, each student in the smaller section should be matched on as many bases as possible with a student in the larger section. If feasible, the matching should be done before the experiment begins.)
   a. *Intelligence.*—This is to be measured by one or more standard mental tests.
   b. *Scholarship.*—To be based upon the average honor points or the average grade in previous courses, preferably at the University of Minnesota, over at least two quarters of work. For freshman students high school records must suffice.
   c. *Sex.*—There should be approximately the same ratio of men and women in both sections.
   d. *Class.*—Students should be matched as nearly as possible as to college class, such as freshmen, sophomores, etc. The more homogeneous the group is, on this basis, the better.

C. INSTRUCTOR

1. The same instructor should teach both large and small sections.
2. The instructor must be prompted by an attitude of scientific inquiry toward the problem.
3. If any deviations in methods of instruction or classroom management are made between sections they should be faithfully recorded.
4. To counteract any effect that practice in teaching the particular lesson might have, the large section should precede the small during one quarter and the order be reversed the next quarter.

If the course extends over only one quarter, one section should be kept a day or two ahead of the other during the first half of the course, with the order reversed during the remainder of the quarter.

D. MEASUREMENT OF ACHIEVEMENT

1. *Examinations.*—Examinations should be given to both sections at the same time, as nearly as feasible. Frequent short quizzes are recommended in order to secure adequate bases for measurement. The more definite the questions are, the greater reduction there will be in the element of subjectivity. All reading of test papers should be done by the same person in a uniform manner and without knowledge of the identity of the writer. If there is more than one reader, each should grade the same portion of all of the papers rather than all of a part of the papers.
2. *Marks.*—The procedure by which the instructor arrives at the final rating should be recorded in detail. This should include such matters as weight given to daily work, weekly quizzes, mid-quarter examination, final examination, notebooks, etc., etc. This point cannot be too strongly emphasized. A copy of each test and examination should be filed with the records of the experiment.

E. OTHER ESSENTIAL CONSIDERATIONS

1. ....
2. ....
3. ....

II. Desirable, but Not Essential, Considerations

A. STUDENTS

1. *Training.*—The relation of the course to the students' previous training should be considered and equated if the effect of that training is felt to be significant.
2. *Experience.*—Students' previous experience in this field should be noted. If it is likely to affect achievement in the course it should be equated. (For example, in agricultural courses the students' previous farming experience would probably be influential.)
3. *Load.*—The student load of each member of each class should be recorded.
4. *Objective.*—Each student's curriculum, with major and minors, should be recorded.
5. *Preference.*—At some stage of the experiment it is desirable to ascertain each student's preference regarding class size. The date on which this information is secured should be recorded.

It would be even more enlightening to secure this information at the beginning of the course and again at the end, with the students' reasons for their preference in each case.

B. INSTRUCTOR

1. *Professional Load.*—A record should be made of the instructor's professional load under the following headings:
   a. Number of courses taught during that quarter.
   b. Number of student credit hours of teaching that quarter.
   c. Number of weekly clock hours of teaching that quarter.
   d. Amount of time per week devoted to research.
   e. Approximate time spent per day in preparation for teaching.
   f. Approximate time spent per day on other professional duties.
   g. Years of experience in teaching
      (1) Total teaching experience
      (2) Experience in this department
      (3) Experience with this course
   h. Character of course in which experiment is being made
      (1) New or well-established
      (2) Nature of students (freshmen, sophomores, etc.)
      (3) Nature of course (lecture, recitation, laboratory, etc.)
      (4) ....
      (5) ....
   i. Amount and nature of assistance provided.
   j. Other influential factors.

C. EXAMINATIONS

As many quizzes and examinations, both of the "old type" and of the objective type, should be given as possible. The subcommittee on class size will be glad to give any instructor who contemplates making an investigation all of the assistance it can in planning both the experiment and the examinations. Professor D. G. Paterson's book *The Preparation and Use of the New Type of Examinations* (World Book Co.) will be found very serviceable.

D. MARKS

All possible effort should be made to secure reliable, valid, and meaningful marks.

E. TIME ELEMENT

1. The sections should meet as nearly as possible at the same hour of the day. If they must meet at widely different times of the day, the order should be reversed about the middle of the experiment.

2. The total time that the students spend on the course should be as nearly as possible the same for both sections. If, because of holidays or for other reasons, one section misses a class meeting, it is advisable to equate that loss in some manner in the other section. This might be done by spending the period on matter that will not figure in the final results.

F. MAGNITUDE OF DIFFERENCE IN CLASS SIZE

The minimum size of the small section will probably be determined by instructional cost and the maximum size of the large section by such physical conditions as the size of the room, amount of laboratory equipment, etc., etc. It is desirable to have as many combinations of size-differences tried out as possible. The difference in size between the two sections should, however, always be so much bigger than any other variable in the experiment that any difference in results is more apt to be due to class size than to any other factor. For the results to have real import, it would seem that one class should be at least twice as large as the other.

G. OTHER DESIRABLE CONSIDERATIONS

1. ....
2. ....
3. ....

APPENDIX B

CLASS-SIZE QUESTIONNAIRE TO STUDENTS

Class-Size Inquiry

To the Student:

The purpose of this inquiry is to ascertain student opinion concerning large and small university classes. Please give us the benefit of your experience with such classes by answering fully and frankly as many of the following questions as you can. After filling in the form, slip it into the attached envelope and place it in the campus mail. No stamp is required. Although we have requested your name, feel no hesitancy about any of your replies as no reference will be made to individuals. We solicit your earnest effort to help us with this important problem of instruction.

Subcommittee on Class Size,
Professor Earl Hudelson, Chairman.

A. *Preliminary Information*

Name of Institution.................................College of.....................................

Your name... Age........... Sex.....................

Your classification: ....freshman; ....sophomore; ....junior; ....senior; ....graduate.

Major field ....

B. *Opinion as to Class Size*

It is recognized that a class of *20* students might be considered *small* if it were an undergraduate lecture course, or *large* if it were a graduate seminar course, i.e., *large* and *small* are only relative terms.

Collegiate Division	Predominant Type of Course	Number of students to be considered as the Upper limit of small class	Lower limit of large class	Optimum (ideal) size of class
1. Junior college	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....
2. Senior college	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....
3. Graduate	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....

In the accompanying outline, indicate for each type of course *in your major field* what you believe to be the largest number of students, that for instructional purposes, may yet be considered a *small* class; the smallest number of students that may still be considered a *large* class; and also what you consider to be the *optimum* (ideal) size of class for each type of course.

(Subsequent replies will be interpreted in the light of your replies above, i.e., *large* class will refer to those above the limits you have established in column 2, etc.)

C. *Experience with Large Classes*

(Where you want to give more detailed replies than the space provided permits, use the back of the sheets, identifying answers by repeating question numbers.)

1. Approximately how many large classes have you attended in college?
None................; 1 to 5................; 6 to 10................; 11 or more................
2. Approximately how many small classes have you attended in college?
None................; 1 to 5................; 6 to 10................; 11 or more................
3. What size class (large, medium, small) do you prefer to attend?
....
4. What size class yields the *most* satisfactory mark to the student?
....
5. What size class yields the *least* satisfactory mark to the student?
....
6. What type of student does the large class favor?......................................
....
7. What type of student does the small class favor?......................................
....
8. What type of instructor is best qualified to handle large classes?
....
9. Whom do you remember as your best *large-class* instructor?................
....
10. Name of course he taught......................................Year taken......................
11. Why does this instructor stand out as a good instructor of *large* classes? ....
....
....
....
....
12. What type of instruction is best adapted to large classes?.....................
....
....
....
....
....
....

13. Approximately how many personal consultations (office visits for help with course work,—not merely to inquire about marks) do you have on the average per quarter with each *large-class* instructor? ....
14. How many of these have been initiated by you (not due to request from the instructor)? ....
15. How many personal consultations per quarter with each *small-class* instructor? ....
16. How many of these were initiated by you? ....
17. Do you feel that the student in the large class is handicapped by lack of personal contact with the instructor? ....
18. If so, what would you suggest to overcome the handicap? ....
....
....
19. Is the value of a course to you in direct proportion to the number of times you recite or participate in the discussion? ....

D. *Summary*

20. Briefly summarize what in your opinion are the *advantages* of large classes?
    1 ....
    2 ....
    3 ....
    4 ....
    5 ....
    6 ....
    7 ....
    8 ....
    9 ....
    10 ....
21. What are the *disadvantages* of large classes?
    1 ....
    2 ....
    3 ....
    4 ....
    5 ....
    6 ....
    7 ....
    8 ....
    9 ....
    10 ....
22. Also summarize the *advantages* of small classes.
    1 ....
    2 ....
    3 ....
    4 ....

5 ....
6 ....
7 ....
8 ....
9 ....
10 ....

23. What are the *disadvantages* of small classes?

1 ....
2 ....
3 ....
4 ....
5 ....
6 ....
7 ....
8 ....
9 ....
10 ....

24. State frankly what in your opinion might have been done by either the administration or the instructors to improve conditions in the large classes with which you have had experience.

....
....
....
....

25. Add any pertinent comment, not solicited in this inquiry.

APPENDIX C

CLASS-SIZE QUESTIONNAIRE TO FACULTY MEMBERS

February, 1927

To Members of the Faculty:

Greatly increased student enrollment, unaccompanied by a comparable increase in financial support, has forced the University to resort to various economies. One of these is larger classes. The Committee on Educational Research, appointed by the President three years ago to investigate whatever it might conceive to be outstanding educational problems in the University of Minnesota, appointed a subcommittee to study the question of class size.

The subcommittee's investigation is of a threefold nature. First, it ascertained the trend in class size during the past several years and the relation of this trend to the distribution of student marks. Second, it has for three years studied experimentally the relation of class size to student achievement as measured by examinations. The purpose of this inquiry is to learn whether any techniques of instruction or classroom management have been found to be especially suited to larger classes.

The results of this inquiry will be made available to all faculty members. It is hoped that you will give the subcommittee the full benefit of your experience by responding freely to all of the questions that you feel competent to answer. Since your identity will be held in strict confidence, please respond frankly. Your name is requested in case some of your answers are not quite clear. Mail your replies as promptly as possible in the attached return envelope. To be included in the tabulations, all responses must be received by *March 1.*

Subcommittee on Class Size

Earl Hudelson, Chairman

Preliminary Information

Name .... Rank..

College .... Dept...

Institutions .... Date ....

A. *Limits of Class Size*

It is recognized that a class of *20* students might be considered *small* if it were an undergraduate lecture course, or *large* if it were a graduate seminar course, i.e., *large* and *small* are only relative terms. In the following outline, indicate for each type of course *in your special field* what you believe to be the *largest* number of students, that for instructional purposes, may yet be considered a *small* class; the smallest number of students that may still be considered a *large* class; and also what you consider to be the *optimum* (ideal) size of class for each type of course.

Collegiate Division	Predominant Type of Course	Number of students to be considered as the Upper limit of small class	Lower limit of large class	Optimum (ideal) size of class
1. Junior college	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....
2. Senior college	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....
3. Graduate	Lecture	....	....	....
	Recitation	....	....	....
	Laboratory	....	....	....

(Subsequent replies will be interpreted in the light of your replies above, i.e., *large* class will refer to those above the limits you have established in column 2, etc.)

B. *Experience with Large Classes in College*

(Where you want to give more detailed replies than the space provided permits, use the back of the sheets, identifying answers by repeating question number.)

1. Indicate by a check the approximate number of large classes you have taught in college: none........, one only........, 2 to 10........, 11 or more........
2. What was the approximate size of the largest class?........................
3. Year taught?.................... 4. Name of course?........................
5. Predominant type of course: lecture, laboratory, recitation, other (indicate)?........................
6. Predominant type of student: freshman, sophomore, junior, senior, graduate?........................
7. Course was elective, required and was new, well-established........................
8. Underline reason for organization of your first large class: economy, too few teachers, shortage of classrooms, heavy student election, as an experiment at your request, other reason (please state).

   ....
9. What size do you prefer to teach: large, medium, small, immaterial?

   ....
10. Has experience with large groups made any change in your attitude toward such classes? If so, explain........................

    ....

    ....

    ....
11. Check in the following list the factors upon which you base the final marks which you assign to individual students:

    (a)........Gross accomplishment in subject;

    (b)........Improvement in subject;

(c)........Industry and application;
(d)........Mental ability;
(e)........Personality of student;
(f)........Maturity;
(g)........Regularity of attendance;
(h)........Initiative and originality;
(i) ....Attitude toward teacher;
(j) ....Class—i.e., undergraduate or graduate;
(k)........Participation in class discussions;
(l) ....Others—please list ....

....

12. Indicate by checks which of the following devices you use to measure accomplishment in your subjects. Please star (*) those which in your opinion are particularly fitted to measure achievement in large classes.
(a)........Objective final examination
(b)........Essay-type final examination
(c)........Objective mid-quarter exam.
(d)........Essay-type mid-quarter
(e)........Frequent short quizzes
(f)........Personal conferences
(g)........Notebooks
(h)........Term papers
(i) ....Frequent problems
(j) ....Class reports
(k)........Demonstrations
(l) ....Class discussions
(m) Other (please state)..

....

C. *Assistance*

13. Have you had assistance in conducting your large classes?........................
14. Who assisted you, graduate student........, instructor........, other?..............

....

15. What was nature and extent of the assistance? (e.g., taking roll, reading papers, preparing mimeograph articles, assembling illustrative material, etc., etc.)..

....

....

....

....

16. Was your assistance all outside of the classroom? If not, explain.

....

....

....

....

17. In your opinion, what kind and what amount of assistance is most useful as an aid to large-class instruction? ....

....

....

....

....

....

D. *Teaching Procedures*

18. What *teaching* methods have you found most successful in your large classes? ....
....
....
....
....
....
....
....
....
....

19. What methods of *class organization* and *classroom management* have you found most successful in your large classes? ....
....
....
....
....
....
....
....
....
....

20. Did you find it necessary or advisable to depart from or modify your customary procedure with small or medium-sized classes in any of the following functions to adapt them to large groups? If so, please explain briefly.
    (1) Assignments ....
    ....
    (2) Use of syllabus..
    ....
    (3) Use of textbook..
    ....
    (4) Class routine (roll, passing paper, etc.)..
    ....
    (5) Maintaining discipline ....
    ....
    (6) Class organization ....
    ....
    (7) Teacher preparation ....
    ....
    (8) Amount of talking by teacher...
    ....
    (9) Extent of ground covered in course...
    ....

(10) Content of course..
....
(11) Maintaining standards ....
....
(12) Use of illustrative material...
....
(13) Use of other devices..
....
(14) Student participation ....
....
(15) Acquaintance with students...
....
(16) Personal conferences with students...
....
(17) Adapting work to individual student...
....
(18) Attention to inferior student...
....
(19) Attention to superior student..
....
(20) Student written work..
....
(21) Handling make-up work ....
....
(22) Outside reading requirements...
....
(23) Tests and examinations (frequency)..
....
(24) Tests and examinations (types)..
....
(25) Reading papers ....
....
(26) Grading students ....
....
(27) Maintaining records ....
....
(28) ....
....
(29) ....
....
(30) ....
....

E. *Physical Conditions*

21. Indicate under the following heads the physical conditions, which in your opinion are most conducive to effective large-class instruction.

22. What type of seat is best?..
23. Should seats be arranged in straight rows or circular?...............................
24. Should floor be pitched or level?...
25. What type of artificial lighting is best?...
26. Should a raised platform be provided for instructor?..................................
27. What provision should be made for illustrative material?.........................
....
28. What other room conditions should obtain?..
....
29. What time of the day is best for large classes?..
....
30. What other physical conditions are important?..
....
....
....

F. *Summary of Advantages and Disadvantages of Large Classes*

31. Please list what you consider to be the advantages of large classes. Star (*) those advantages which you feel can accrue *only* in large classes.
    1 ....
    2 ....
    3 ....
    4 ....
    5 ....
    6 ....
    7 ....
    8 ....
    8 ....
    9 ....
    9 ....
    10 ....
32. Please list, similarly, the *disadvantages* of large classes. Star (*) those which you feel are *inherent* to large classes.
    1 ....
    2 ....
    3 ....
    4 ....
    5 ....
    6 ....
    7 ....
    9 ....
    10 ....
33. What educational aims are large classes best adapted to realize?..........
....
....

34. What educational aims are large classes least adapted to realize?..........

....

....

....

35. Which size is better for developing student initiative?..........

36. What type of student is handicapped by large classes?..........

....

37. What type of student is favored by large classes?..........

....

38. What effect does class size have upon the percentage of failures?..........

....

39. What effect would homogeneous grouping have upon the success of large classes? ....

....

....

40. On what basis should students be grouped?..........

....

41. What relation has the size of class had to the physical strain upon you?

....

42. What relation has the size of class had to the emotional strain upon you? ....

....

....

43. In your field, what type of work is *best* adapted to large classes?..........

....

....

44. In your field, what type of work is *least* adapted to large classes?..........

....

....

45. What kind of instructor is best qualified to handle large classes?..........

....

....

....

....

....

46. If your weekly student-hour teaching load remained the same, under which of the following plans would you prefer to teach: (a).......... 3 large classes; (b)..........6 small classes; (c)..........2 large and 2 small classes?

47. If you have ever made an *experimental, quantitative* comparison of the relative effects upon pupils of large and small classes, what, briefly, were the results?..........

....

....

....

48. What, in brief, is your attitude toward class size?..

49. Remarks (Use this space to include any pertinent comments not solicited in this inquiry)..

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